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For

E: B: Sugden Esqre

from his friend &

Obliged Servant

The Author

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Chirurgical Institutes,

DRAWN

FROM PRACTICE,

ON THE

KNOWLEDGE & TREATMENT

OF

GUN-SHOT WOUNDS,

ILLUSTRATED WITH SOME SINGULAR CASES, AND CURES OF GALLANT WARRIORS,

By H. St. JOHN NEALE Esq.
SURGEON,

Formerly of His Majesty's 5*th* Regiment of Infantry, and 16*th* Regiment of Light Dragoons, during the late War in North America.

In tenui Labor———

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1804.

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To

Field Marshal, His Royal Highness FREDERICK DUKE OF YORK, *Commander in Chief of His Majesty's Forces, &c. &c. &c.*

May it please your Royal Highness

TO do me the honor, though an individual of

of inconsiderable station in the dominions of our justly revered and beloved SOVEREIGN, yet a moſt dutiful and loyal Subject, graciouſly to accept the following treatiſe on the knowledge and treatment of Gun shot Wounds, founded on long practice and experience during the laſt war in North America; which I moſt humbly preſent to you, and

of

of which I entreat your ROYAL HIGHNESS's favorable conſideration.

That your ROYAL HIGHNESS has been pleaſed to honor this your native land, ſo far, as to concern yourſelf with all it's military affairs, and to diſcharge an office of the greateſt importance to theſe united Kingdoms, with that perſonal care, and admirable

mirable ſagacity, by which you are diſtinguiſhed, at a time when a juſt and indiſpenſible war requires the aſſiſtance of the *wiſeſt heads*, and moſt courageous hearts, is an ample confirmation of the *ardent zeal* your ROYAL HIGHNESS has manifeſted on all occaſions, to ſupport and advance the true intereſt and welfare of the army, and to render it an efficient

and

and powerful means of ſerv-ing and ſaving our happy and invaluable conſtitution, in oppoſing the ſecret machinations or open attempts of an inſidious, faithleſs, and audacious foe, who dares to threaten the deſtruction of our religion, government, and nation.

Your Royal Highness will pardon me for obſerv-

ing

ing, that it is ſincerely to be wiſhed, (for your own good ſense and matured judgement muſt ſee the propriety of the wish,) that the royal army may never want a director at the head of the uſeful and important department of surgery, who has seen actual service, and maturely observed and experienced, the nature, symptoms, and treatment of Gun shot Wounds; as

as this part of ſurgery does not ſo particularly belong to the *City* ſurgeon, or even to the Army ſurgeon, whoſe experience has never extended farther than the parade at home; domeſtic wars, thanks be to providence, not being here frequent.

Now, as theſe wounds are artificial, ſo it is obvious that they ſhould meet with an experienced

perienced practitioner of art to undertake them; which experience is the only ſure baſis on which the army ſurgeon can ground his practice, and from whoſe aſſiſtance, when ſo improved, there will be the greateſt probability of ſucceſs.

It is he alone, permit me, ROYAL SIR, to remark, who can check groundless fear in the patient, and banish real danger

danger by his judgement; who can foretel symptoms, and anticipate fatal accidents; proving a comfort to the ſoldier in the day of battle, as well as a friend in his more peaceful occupations.

The great uſefulneſs of experience in the treatment of *Gun-ſhot Wounds* to the army ſurgeon, in reſtoring and preſerving the health of the wounded,

wounded, muſt be obvious to every reflecting mind; and as the relief of the brave ſoldiers of the Britiſh army under your ROYAL HIGHNESS's auſpicious command, who may ſuffer by the common accidents of war, is an eſpecial object of your ROYAL HIGHNESS's care and compaſſion; a treatiſe, that experimentally lays down, and preſcribes particular rules for the treatment of ſuch accidents,

dents, can never be unacceptable to a Prince of your illuſtrious Character.

As an homage therefore, to your ROYAL HIGHNESS's acknowledged merits, I ſhall eſteem your favorable acceptance of this work, which has been compiled with (at *leaſt*) much labour and induſtry for the benefit of the army, as a very ſingular honor; *indeed*, one of the greateſt that can be

be conferred on me. And your ROYAL HIGHNESS will be graciouſly pleaſed to permit me to avow, that I am with ardent zeal, inviolable fidelity, and moſt profound reſpect,

May it please your Royal Highness,

YOUR ROYAL HIGHNESS'S,

Moſt obedient,

moſt devoted, and

moſt humble Servant,

H. St. JOHN NEALE.

61, *Frith Street,*
Soho Square.
19th Feb. 1804.

ADVERTISEMENT.

THE account of the accidents which form a considerable part in the very interesting subject of the following pages, the public will please to observe, was penned chiefly in a camp, in all the hurry and bustle of active warfare; without at the time, any thought of ever publishing them farther than among my private friends and perhaps in conversation. But in consideration of the present awful crisis, when this great and high spirited nation is threatened with invasion by a fierce and haughty foe, and every man's breast burns with ardour, to contribute, in some manner to repel his efforts, I have collected all my scattered notes written in the American War, and made such professional observations on them as I trust may prove beneficial. Without pretending to any critical exactness of style, or aiming at ornament of language, and without wishing to appropriate to myself whatever may be here thought worthy of approbation, I freely communicate whatever

ever reason and experience have taught me, in hopes that what is here suggested may prove serviceable to the young practitioner, as well as to others who may not have had opportunities of seeing much practice in this important branch of surgery.

THE heart of every medical man, I am satisfied, glows with a warm desire to be qualified, and to be enabled to render every possible assistance and relief from surgery, to those brave and gallant warriors who are emulous of lavishing their lives in the glorious cause of their beloved Sovereign and his dominions, and are eager to maintain the hitherto untarnished honor of England, with their wonted alacrity, and with that intrepid and well regulated valour, which has so long been the noble and distinguishing characteristic of her sons.

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ERRATA.

Page 22, in the note, line 15, for *deportment* read *department*.

Page 122, line 17, and where it occurs for *plentitude* read *plenitude*

Page 137, in note, line 1, for *ply* read *apply*.

Page 271, line 7, and where it occurs, for *languiferous* read *sanguiferous*.

Page 275, line 18, for *are* read *as*.

Chirurgical Institutes,

DRAWN FROM

PRACTICE

ON

THE KNOWLEDGE AND TREATMENT OF

GUN-SHOT WOUNDS.

CHAPTER I.

BEFORE I enter upon the general treatise of gun shot wounds, let us take a small view, and see, what gun-powder and shot are made of. Gun-powder, it is well known, was discovered by a franciscan fryar, named Bartholdus, anno 1380, being an alchymist, was the first that found out its true composition. Roger Bacon, in the year 1284, makes mention of gun-powder, as well as some others before him; but it never came

at its due perfection of composition, till the time of the aforesaid fryar. This composition is framed out of three simples, viz, saltpetre, sulphur, and the sallow, or willow coal. These, therefore, in their essence must be allowed to be void of all poisonous quality.

Sulphur is a very useful medicine, and saltpetre also, is an admirable medicine. They are both given internally for the cure of diseases. Sallow, or Charcoal, which is the third ingredient, and which causeth the ignition, is entirely void of all poison.

With regard to the shot or bullet, which is generally made of lead, it is well known also that this metal, of its own nature, contains no poison, and it is not unfrequently used in its own metalic form, as well as various preparations made from it, in external applications on the surface of the human body.

Besides, I have had opportunities of seeing many bullets lodged in the body, and there to have remained for years, without any hurt or detriment to the patient, after the wound by which it entered was perfectly healed. Lead therefore, of its own simple quality, is void of poison.

The

The author makes this observation on account of the erroneous opinion of the old practitioners, who have written upon this subject. The consequence of which was, that the first thing they did, was to endeavour to extract the ball as soon as possible after the patient was wounded, if it was ever so deep lodged, either in muscles, bones, tendons, or ligaments; and to effect this, they made use of clumsy and rough instruments, such as long probes, forceps, and the terribellum or screw, by which means there must have been terrible havock committed on wounds, not unfrequently ending in destruction. It seems to have been considered by them as the greatest object to get out the ball, when in fact it is no object at all, when lodged in fleshy parts, unless it can be done with ease and safety.

The inexperienced will often be surprised at the black appearance which a gun shot wound generally puts on, and the reason which is often given for it, and has long been universally believed, that it is the effect of heat brought by the bullet, but this supposition is erroneous. When a hard body which is thrown by gun-powder, is possessed

of its full force, it always makes a wound, whether it only touches the surface of any member in its progression, or if it strikes in a direct line. In this case the violence with which it is carried, makes a more or less deep eschar along the whole extent of the wound. This *eschar is of a black colour, but is not a burn as many have fancied, though made by fire-arms.

In the days of Ambrose Parré, a famous surgeon, who had seen much active service during several campaigns, the blackness of the eschar was attributed to the heat of the bullet, and this celebrated practitioner, has given that opinion in his ingenious works. While the eschar keeps adhering, it obdurates the mouths of all the vessels in contact with it, and thereby stops the circulation on the surrounding parts. For when extraneous bodies are brought in, and as it were incrusted in the substance of the

* By eschar is meant a portion of flesh beaten, and crushed by a bullet or any extraneous body, and which lines all the inside of the wound, and prevents all circulation or commerce with the circumambient or soft parts.

part

part, the circulation becomes impeded by the stricture of the reticular substance, and by the tonic convulsion of nervous parts, these causes conspire at once to produce that ecchymosis so common in gun shot wounds, and the hideous swelling which, I have often observed to drown the whole member.

In the moment of the blow, the foreign body drives the blood of the ruptured vessels into the interstices of those which escape, the eschar suspends and stops the circulation of fluids in all the vessels which terminate there, and a strong and quick constriction of the reticular substance coming on, shuts up all the small vessels. Thus many of them burst from turgency, the blood spreads more and more through the interstices of the fibres, and sometimes forms in different parts a number of clods, similar to those formed by contusion, where there is no wound. This extravasation, called ecchymosis, reaches sometimes very far under the skin betwixt the muscles, and even in their fleshy bodies. While it remains, it is a great obstacle to the fluids in circulating freely through the sound vessels, that are compressed by it.

This

This eschar, be it deep or superficial, adheres to those surrounding fleshy parts, and some days are required for its separation, which is effected much sooner, if a proper dilatation has been made immediately after receiving the wound, by means of warm digestives, emollient cataplasms, and the peruvian bark. The nutritious juices will by this means run out from their minute vessels, and by degrees separate the dead from the living part.

CHAPTER II.

Of gun-shot wounds in general, and the accidents which seize the whole animal œconomy, from the moment of receiving the wound.

EVERY wound is called gun-shot, that is made by any body discharged from fire-arms; such wounds require the surgeon's greatest attention, because, they are all complicated, and the bullet or whatever body it is, thrown by gun-powder, acquires such a rapid force, that the whole animal machine participates

participates more or less in the shock, and agitation which is communicated to the part, the very moment it is struck. The accidents that spring from this cause, though for the most they appear to be no more than momentary, not unfrequently occasion others, which arise not till some time after in the progress of cure. Hence the accidents that happen in the cure of such wounds, may be distinguished into three classes.

Some of them appear at the very instant the ball has entered, or within twenty-four hours after. Others come not on till some days but are always in the first fortnight. Others again happen after a certain period of time. All these shew themselves in the whole habit of the body, at the part directly wounded, and sometimes over the whole member.

But when I observe on these accidents, I would not be thought to say, that they necessarily happen always; for we often observe these wounds to heal very kindly, which may be owing to a stronger or weaker habit of body, a greater or less disposition of the fluids towards inflammation, or the nature

ture of the wounded part, besides many other circumstances.

When the habit of the patient is good, there are no wounds made on the human body, that heal more kindly than those made by gun-shot on fleshy or muscular parts, provided, the surgeon understands his business. Health being so great a blessing, that we can never be deprived of it without regret. Upon this principle, which nature has set up in all mankind, it is, that so soon as one feels himself wounded by fire-arms, he is struck with a panick oppression, too violent to be smothered. At that very moment the reason of the bravest man that ever entered the field naturally feels some degree of agitation and confusion, and sometimes, on that very account, there follows a sudden depravation, or a total suppression in many of nature's operations. Indeed, it is scarcely possible that a solid body, driven by gun-powder, should strike any part of the human body, without communicating at the same time an agitation, like a shock from an electrical machine highly charged, proportionable to its quantity of matter, to its velocity, and to the resistance of that part. This agitation is technically named

COMMOTION ;

COMMOTION: it happens always in the wounded member, and all those gentlemen of the profession, who have seen active service in armies, must have learned from daily experience, that it is communicated to the whole machine. Hence, the whole nervous system is galled and irritated, and often thrown into strictures or tonic convulsions, not unfrequently the source of other consequences. Some of the wounded feel a general numbness, and weight; others are seized with frequent SYNCOPES; one falls into convulsive motions, such as hiccup, vomiting, irregular shiverings, or a tonic stiffness in the whole body; while another becomes yellow, green, or of a plumbane colour, &c. It is well known, that all parts of our bodies are connected by means of a reticular substance.

This is a kind of net-work, that serves as a canvas, if I may be allowed the expression, in which all our vessels are interwoven. Notwithstanding which, in a natural state, all these fine vessels are free enough, provided the circulation of their fluids be undisturbed. But when strictures come on, that is, when the

meshes of this net-work are drawn together by a spasmodic convulsion, the vessels that creep among them are constringed. as if surrounded with a ligature. Besides, the nerves are no more exempted here than the blood vessels; hence the stream of animal spirits becomes partly intercepted, or entirely suspended. The numbness and weight sometimes felt through the whole body, is almost a necessary consequence of this doctrine, if the stream of animal spirits is allowed to be the cause of sensibility and motion, hence such accidents will be proportionable to the degree of COMMOTION. As the nervous system is under a greater degree of irritation when the wounded part is tendinous; than when fleshy, so the numbness and weight will likewise be more considerable. The universal coldness, which the wounded sometimes complain of, even in a warm season, without any external cause, proceeds in the same manner from the interception of the fluids in their circulation, which cease now to move on with freedom; for natural warmth depends partly on the progressive motion of our fluids. This coldness may likewise be occasioned

occasioned by loss of blood, if any considerable hæmorrhage has happened.

The SYNCOPES, may be occasioned by three different causes; first, a suspension of motion in the nervous system, which is sometimes the effect of fear; second, the irregularity of its motion, which may bring on a spasmodic convulsion in the fibres of the heart, whence this will be disturbed or stopt in its action for a few moments: third, a dissipation or loss of that fluid, if a hæmorrhage has preceded.

The hiccup, when it is not owing to some wounded viscus, or the intestines, the convulsive shiverings, vomiting, convulsive motions of the limbs, or general stiffness in the body, are all accidents that spring from an irritated nervous system.

It must be confessed, that the regularity of our voluntary or mechanical motions, depend on the free and regular course of animal spirits; no wonder then, if an irritated nervous system determines their stream more to one part than another, or even drives them on with some degree of confusion. When the patient turns yellow, green, or of a leaden

colour in a short time after being wounded, it is undoubtedly owing to this, that the shock or commotion has stopt the due secretion of bile, or perhaps some other liquor.

And that excrementitious fluid, not being so freely separated from the mass of blood as formerly, is accumulated, and at last transuding through the sides of small vessels, communicates its hue to every part.

CHAPTER III.

Observations on the part itself, immediately after receiving the wound.

We shall comprehend all the disorders, which can be produced by fire-arms, into two particulars, viz. a simple or complicated contusion, and a wound which is always attended with an eschar. But then the wound may be complicated, with a contusion or fracture of the bone; with the lodgement of some extraneous body, or perhaps with a hæmorrhage.

hæmorrhage. A hard body, when thrown with the force of gun-powder, may strike any part of the body, and only bruise that part, without making a wound.

This will sometimes happen, when that body has been thrown from a great distance, and being near the end of its course, has its force greatly diminished. But whether it strikes in an oblique or straight direction, it always occasions a more or less superficial contusion. When I speak of contusion, I wish to be understood that we mean a pressure upon a great number of vessels, whereby some of them are deprived in part of their natural spring; others lose it altogether; and others again suffer a rupture under the skin, while the skin itself is not destroyed. Thus in every contusion there is an extravasation of blood from the ruptured vessels; and that blood is either found out forming a clod in one or more places, which it makes for its own lodgement at the bruised part, or it ouzes into the cellular substance round the circumference. Such infiltration of the blood is termed ECCHYMOSIS. If the vessels under the skin are broken, it makes a solution of continuity;

continuity; and therefore in speaking of gun-shot wounds, we shall include all sorts of contusion occasioned by fire-arms. Whatever be the nature of a contused part, the effect of the blow is nearly the same; that is, the vessels are there stretched or broke, and the fluids extravasated, but then we are not to look upon all contusions in one light; for tendinous parts, cartilages and bones are, from their natural structure, more susceptible of bad accidents when bruised, than what are called the fleshy parts. These last are of a large texture, and the fluids extravasated amongst them soon dissipated by transpiration, after which the vessels return gradually to their former spring and elasticity.

The dense texture of tendinous parts, such as ligaments, sheaths, APONEUROSIS, &c. do not so easily allow the extravasated fluid sto be discussed, and thereby gives them occasion to change their nature; which change necessarily brings on inflammation, and sometimes gangrene or mortification of the APONEUROSIS. Cartilages and bones are still of a more dense texture. Let us suppose then, what is very possible, that a rupture

and

and ECCHYMOSIS happens to the investing membrane of the bony cells: In this case a discussion being very difficult, the cartilage or bone may be affected in some degree. Besides, a cartilaginious or bony substance does not easily re-assume its former spring, after it has been destroyed by a stretching of its fibres. And as the soft parts under the skin suffer laceration in a contusion without a wound; so a contusion and fracture of a bone may be produced at the same time. A bone may be contused, or even fractured, by a spent ball, without any wound in the fleshy parts, as I have often had occasion to observe during the campaigns in North America, and and much more may it be so when these are wounded. Though the contusion of a bone may seem to be a matter of no consequence, yet it is not always really so. For experience has sometimes demonstrated to me, that the agitation of the constituent parts of a bone, has been communicated to the marrow, to its investing membrane, and even to that which lines the bony cells.—For, some time after, these membranes have suppurated,

purated, and produced a collection of matter in the substance of the bone, as I shall have occasion to observe hereafter. A fractured bone would be of itself less dangerous than a contused one, provided it could be confined, and was not accompanied with a laceration of the membrane that lines the internal cavities, as well as of the PERIOSTEUM, and all the portions of muscles that are inserted into, or arise from the broken part.

Fractures of this kind are very seldom found smooth or level; and supposing the bone to be broken quite through, or only in part, the splinters that adhere to the body of the bone, by some muscular or membranous connexions, lose the equality of surface; and hence there necessarily follows a laceration of the soft parts, which will sometimes reach much farther than the eschar. But notwithstanding such laceration, the pain which a person feels at the time of receiving a gunshot wound, even supposing the wound to be very large, as when a leg or thigh is quite carried off, the pain (as I have had occasion to observe) in this case is not so considerable as might be imagined; but commonly the patient

tient complains only of a weighty uneasiness in the whole member, as if some large and weighty body had fallen on it, or as if something very bulky had struck him, without making a wound. But in a few hours after the pain grows sharp, and increases according to the nature of the wounded part. Wounds, therefore, of tendinous parts, become exquisitely painful, while those of fleshy parts are naturally less susceptible of it. The first sort, for that reason, are much oftener followed with disagreeable accidents. For pain causes a trembling or convulsive motion, of a greater or less degree, in all the wounded member, which, if it continues long, disturbs the circulation, and brings on a surcharge of fluids. We learn from experience, that inflammation and gangrene, are not unfrequently the consequences of violent pain in any part.

Violent pain exasperates the blood, throws the animal spirits into disorder, and exhausts the patient's strength, by occasioning a great expence of these spirits. Hence the divine

remedy, opium, must (by its admirable virtues) be called to our aid, to support the nervous system. I have been an eye-witness, in some hundreds of cases, where it put a stop to a gangrene and mortification, even after they had commenced, by its wonderful properties alone.

CHAPTER IV.

Of the different kinds of extraneous bodies, sometimes carried into gun-shot wounds.

IF the ball which makes a wound, passes not quite through the member, it must necessarily remain either in the flesh, or among the pieces of bone, when one is broken.

Its stay there may produce more or less mischief, according to its matter and form. The matter may be of some metal, such as a brass button, disposed to gather verdigrease,

grease, and the form may be irregular in various degrees; for a leaden bullet always undergoes a change of figure when it touches a bone; (I have upwards of one hundred in my possession, quite flattened, and squeezed into angular forms, extracted during the campaigns in North America,) and then its inequalities exasperate the neighbouring parts, whereby it is so locked in, that its extraction is rendered very difficult. Hence the necessity of proper dilatations as soon as possible after the bullet has entered. I have seen so many evils, arising in consequence of gun-shot wounds not being properly dilated, that I cannot recommend *it* too strongly to the attention of the surgeon, who may happen to be in the field of action, upon those occasions. For after inflammation and tension comes on, which is always rapid, it may be too late to do a most necessary duty. The bullet is not the only extraneous body that is to be found in the wound; for, if it has pierced through, and carried away a piece of the garment, that piece of stuff is pushed before it; so that we meet with woollen or linen

rags, &c. in wounds, every day. Even when the bullet is gone, having run quite through the member, one is almost sure to find the stuff that came in with it, especially if the bone be broken.

It were to be wished, that we could lay down certain rules for determining the place where such pieces of cloth, &c. lurk; we can only say in general that they are blended with the eschar, and when a bone is fractured, it is more than probable that they are entangled among its inequalities. Besides these, many other kinds of extraneous bodies are to be found in gun-shot wounds. Buttons of the patient's clothes, pieces of money, or other things which were in his pocket. I have known a pen-knife to make terrible havock on the thigh when struck by a ball.* Sometimes splinters are separated and carried to some distance from the bone to which they belonged; and wherever such bodies run, either from their inequalities or hard-

* Case of Serj. Miller, 16th Light Dragoons.

ness,

ness, they make a laceration and eschar along the whole tract.

The havock we have been speaking of, cannot happen in any part without a destruction of all the blood-vessels that were in the way of the ball, whether they happen to be small, large, or of a middle size; if they were small, we may conclude, from what has been said of the contusion and eschar, that the wound will bleed but little. But if the extraneous body has opened any considerable vessel, the eschar will not be able to oppose the impulse of the arterial blood. It is therefore erroneous to think (according to the opinion of some authors, who have written upon gun-shot wounds) that no gun-shot wound bleeds; for we often see many of the wounded lose a great quantity of blood, and even for want of assistance in the field, sink under a fatal hæmorrhage.* Besides, it may so happen, that

* When I had the honor to attend on the 16th, or Queen's regiment of light Dragoons, in North America, commanded by the Honourable Colonel Harcourt, (now General) I instructed all the non-commissioned officers in

a middle sized vessel being opened, and its sides pressed together by the eschar, the hæmorrhage shall not appear till some hours after, when the fever advances and accelerates the motion of all the fluids. If the hæmorrhage is moderate, it may be useful in preventing many ill accidents; but when large, it may kill the patient, or reduce him to the verge of destruction.

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the application of the tourniquet, and as detachments of this gallant corps were constantly exposed on patroles and reconnoitring parties, every officer carried one in his pocket, by which means several lives were saved. Such a corps as the above in his Majesty's service was never excelled, (indeed, but seldom equalled) as all the regulations of its interior orders, and the hidden springs of all its movements and actions were so well contrived, and the mechanism was ever so exquisitely adjusted, that the whole as well as every part of a system, containing 800 human forms, mounted on the finest horses, appeared at all times in their tents, their hospitals, under arms, and on a march, to be actuated and put in motion, merely at the volition, and by the command of their noble Colonel, and the gallant Major Gwyn, (now also a General) each in his deportment co-operating with one mind, to effect that entire and beautiful arrangement, the like of which, in its interior, as well as exterior appearance, I almost despair ever to see again.

The

The next accidents to be observed after receiving a wound, are tension, swelling, and sometimes mortification. The extravasation as I have before observed, called ecchymosis, reaches sometimes very far under the skin, betwixt the muscles, and even in their fleshy bodies. While it remains, it is a second obstacle to the fluids in circulating freely through the sound vessels that are compressed by it. This is what occasions, in the wounded member, the swelling which almost always comes on in a few hours after ; a swelling that is more or less considerable, and always more dangerous when above the wound than when below it.

It is natural for the member to swell below, because the return of its fluid is checked , but the reason holds not with regard to the swelling above, and whenever it happens, we are sure some tendinous part has suffered, in which case, the inflammation may shew itself round the whole, that is, above as well as below the wound.

Supposing that a stricture of the nervous system occasions a numbness and weight in the

the part, as we have seen it sometimes cause these over the whole body, if that symptom goes not off soon, it always prognosticates others still more serious, and if the help which art points out, be not speedily used, the swelling very often rises to such a degree, that the close texture of the skin will not permit a dilatation, proportionable to the acquired bulk of the parts it covers. Hence, I cannot help again repeating the great advantage arising from a plentiful dilatation as soon as possible after receiving the wound.* When the inflammation, tension, and swelling runs high in those wounds that have not been properly dilated, or perhaps from want of assistance on the spot, these parts may mortify for want of circulation, even before

* The late Mr. John Hunter, for whose memory I have the highest respect, it is well known, condemned the practice of dilating gun-shot wounds, which opinion, every Gentleman of the profession, who has seen active service, I am well assured, must consider as one one of the most absurd ideas ever sent forth to the world, and from one of so much celebrity, it must have proved of the most dangerous tendency.

the

the skin becomes discoloured, and all our cataplasms, fomentations, and our divine remedy the bark, with every other reinforcement of our art, may prove ineffectual.

All these accidents may in a little time determine the loss of a limb, or even of the patient's life. The surgeon should therefore labour in good time to remedy or prevent them. It were to be wished, that he was always on the spot, or near at hand, the moment after any person is wounded; for supposing a cure to be possible with the help of the healing art, it may become ineffectual if it is not soon enough brought into practice.

CHAPTER V.

Of what is necessary to be done in the different cases which may fall under the surgeon's care, whether it be contusion or a wound.

THE circulation of the fluids being impeded, and the collection of extravasated blood in the cellular substance of the part, may threaten swelling, inflammation, and gangrene, as we have often seen, and the splinters of bones, if any are broken, will prick and irritate the nervous system; extraneous bodies, if any be introduced, will fatigue nature by their weight and inequalities; the blood may stream from some vessels in such quantity, as to deserve the surgeon's serious attention, or at least from considering the situation of the wound, perhaps a hæmorrhage may be dreaded. Our indications of cure are to be deduced from all these particulars, in order to determine the best manner in which the surgeon ought to conduct himself. If he delays, or if the swelling and inflammation advances,

vances, he will find great difficulty in doing what is necessary. There are four indications to be fulfilled in order to perform a cure. The first is, to change the figure, and as much as possible, the nature of the wound, by proper dilatation, making sometimes a bleeding wound of that which was a contused one. The second, is to remove, if possible, all extraneous bodies * The third, is to stop the hæmorrhage. The fourth, is to prevent the accidents which may arise, and to remedy those which already appear. This is what we propose to explain in particular; and that it may be done with as much order as possible, I shall go on in the same method

* If the ball is lodged so deep, that it cannot easily be laid hold of, before or after the dilatation, no violent efforts should be used, with a view to extract it. If it is in a fleshy part it will do no injury, but work itself towards the surface in time, perhaps long after the wound has cicatrized, and sometimes at a great distance from where it entered, I have cut balls out at the ham, which entered the buttocks, and the upper part of the thighs, two, and some balls three years after the wound was healed.

we have hitherto followed. If the contusion be superficial, if it reaches no farther than the ADIPOSE MEMBRANE, and there be no considerable clod formed in some cell, it differs in nothing from a contusion that is produced by any other cause than fire arms.

The use of topical resolvents, such as spirit of wine, a solution of sal-armoniac in vinegar, &c. will, by the active and penetrating parts of such medicines, facilitate the resolution of the extravasated fluids; which is known to be advanced by the colour of the part, the skin becoming then yellow.

But the contusion and ecchymosis, for these cannot be separated, may perhaps be deep. And of this a judgement cannot always be formed by the eye. But by the degree of pain, the swelling of the members, its weight, the loss of its motions, and by reflections that may be made on the nature of the blow, calculating the softness and mobility of the part struck, which was obsequious to the stroke, or gave way with difficulty, and in examining the figure, bulk, and weight of the

wounding

wounding instrument, if it can be found. In this kind of contusion, experience shews that there is not only an infiltration, but likewise an effusion in various places of the contused part; so, that it would be wrong to attempt its discussion. The spring of too many parts has been destroyed to expect it will be restored to them again so soon; and besides, the infiltration, as well as effusion, may be too deeply seated. Hence these fluids are heated up, and fermenting in their confinement, bring on a suppuration; wherefore that must be prevented by making incisions and scarifications, deeper or more superficial, according to the depth of the contusion and ECCHYMOSIS,

If, by chance, the blow has been violent enough to fracture a bone without making a wound, (for I have sometimes seen very firm bones, such as the TIBIA or FEMUR for instance, broken by a cannon ball, while the skin, and even the garment itself, has not been torn) our incisions should not lay the fracture exposed, but only dip into the bodies

dies of the muscles. and among their interstices. These wounds are to be dressed afterwards according to art; and if there is one or more fractured bones, they must be set, and kept in that right situation, by the help of a proper bandage, and suitable posture.

The benefit that arises in these two cases, from the incisions I have proposed, (considering that incisions cannot be made without occasioning the wound to bleed freely) is, that we thereby not only empty a number of little surcharged vessels, which would have evacuated themselves one after another, but also give free discharge to part of the extravasated fluid; this is the true and surest method of preventing the swelling which threatens the member.

If the contusion, which we still suppose to be violent, be upon a joint, it may reach those parts that immediately inclose the articulation, such are aponeuroses, and the capsular ligament. These parts claim much of our attention, and especially the CAPSULA, which

which cannot be opened without exposing the articulation, and the incisions should never penetrate into them, but only into their surrounding ADIPOSE membrane. We know these parts will be liable to inflame, if the nutritious juice extravasated in their substance should change its quality. I know also, that in consequence thereof, they may suppurate and be destroyed; but still, it is unwarrantable to cut them, except when the fluctuation of an effused fluid is perceivable under them.

When such fluctuation is not sensible, we must endeavour to prevent these accidents, or correct them by an exact regimen, copious and repeated bleedings, and by the application of topical emollients, and resolvents, either in the way of fomentations or cataplasms often renewed.

But, in addition to the contusion of the tendinous parts, if the bones that form the articulation be bruised, fractured, or luxated, there remains but little hope of saving the member. 'Tis true, indeed, that in some instances of this kind,

kind, I have seen a limb preserved ; but it is also true, that a much greater number of such patients have been lost than saved. Their fate can be attributed to nothing but to the inflammation of ligaments, aponeuroses, or synovial fat and glands ; in fine, to the suppuration which drowns the whole articulation ; accidents that are most commonly attended with a reflux of purulent matter. If so, it is better to prevent that by amputation, than wait its arrival.

A solid body, shot from fire-arms, may, as it goes along, strike a part, and make a wound only at the surface. Then it may carry the piece quite off, and so form a smooth wound ; or it may leave a hanging flap, as I have often seen, and this will depend on the round or irregular figure of that body, which may be either a bullet, a slug,*

* The American troops, in several engagements, adopted a method of putting two slugs in every ball cartridge, and often four. These were made by cutting a musquet ball into four equal parts, the angles of which, made often a disagreeable wound, to some of our brave fellows.

or

or a cannon ball, &c. In both these kinds of wounds, there is an eschar more or less deep; and though the foreign body struck the surface only, it may occasion an ECCHYMOSIS, a commotion, and even a fracture of some neighbouring bone, without laying it bare. The ECCHYMOSIS and commotion may require that the surgeon make some incisions, of which we have already spoken; but with regard to the eschar, if it is not totally removed, it must be scarified in its whole extent, in order to advance its suppuration afterwards, by the application of proper medicines.

If there be a considerable flap, we must, after scarification or entirely removing the eschar, replace and keep down the flap by a suitable bandage, &c. to spare nature the half of her work, and to forward a cure, that would be infinitely more tedious if it was cut off. These precautions may have the desired effect, I mean, if no inflammation comes on, the flap may grow to again, wherever there is no eschar; but if a swelling rises,

become of no avail, for it is more than probable that the wound will be suppurated.

The wounding body may strike in a perpendicular direction. If it has bulk and velocity enough to take away part of a limb, the wound is never uniform, the bone is never broke smooth, and besides the splinters which may reach much higher than the bone, the bone may be split up a certain length. And farther, the shock may be communicated to the articulation above, and it certainly is so communicated if the wound be near that articulation. Thus its capsula and ligaments are injured. As a proof of this, let it suffice to say, that we have sometimes seen that joint dislocated by the same blow, which took away the lower part of the member. When there is no luxation, the CAPSULA and ligaments have resisted, and which they could not do without suffering a violent extension. The amputation should by all means be made above the joint; if it is performed below, we cannot expect a laud-

able

able suppuration, where the whole nervous system is in a state of convulsion, and where the ECCHYMOSIS, &c. reaches to the joint, and because the stump must soon swell, for the preceding reasons.

If patients have sometimes been observed to die some days after the operation, it is because it was performed immediately above the wound, and below the upper articulation; and because the joint has afterwards swelled, and been seized with inflammation, and the fever has come on in consequence, by which the suppuration has been stopt, the source of many other mischiefs. I have had opportunities of seeing instances where amputation was performed above the wound and below the joint, and as soon as it began to swell, those who have had boldness enough to make a second amputation, which was the sole refuge now, above the superior joint, have commonly seen patients recover, who, without this assistance, to all appearance must have perished.

If the solid body which wounds, has not sufficient bulk or weight to take off a member, it pierces it through, or remains lodged in it. If it passes through and through, the entrance may be distinguished from its passage outwards, by three circumstances, either taken together or separately. 1*st.* The skin is lightly pitted at the place where the bullet entered, and raised towards the place where it went out. 2*nd.* The eschar, contusion and ECCHYMOSIS are much more remarkable on the side of the entrance. 3*d.* The passage outwards, is generally larger than the entrance. This last observation, however is not without some exceptions, for two balls may go in together, when troops are engaged in close action, as I have had opportunities of seeing in America, then separate from each other within the member, and not run out together: It has likewise so happened, that one goes out, while the other is lodged.

Supposing the bullet passes through and through, and touches only the soft parts, the

wound

wound must be enlarged by proper incisions, and converted into a long wound, which can be easily dressed. When there is a small distance beween the entrance and exit, I have often found great advantage by joining the two openings into one, if it was possible, without dividing any tendon or considerable blood vessel: But supposing this to be impossible, we must cut, both on the side of the entrance and exit, as far as the parts concerned will permit, in such manner, that the whole path of the bullet be wide enough to keep always a free communication between the two wounds.

If this has been neglected, the sides of the division will approach each other by the swelling which may arise upon the part, and the suppuration will be established with greater difficulty. If the tract of the ball be long, as happens when it perforates any member in an oblique direction, according to its length, the two wounds cannot be joined into one, nor can their communication be rendered so free as we have proposed, but this inconvenience may sometimes be supplied

plied by making counter openings at some distance from each other.

It is true indeed, that this does not fulfil our whole intention; however, we evacuate some of the fluids; but the wound cannot be made to bleed freely along its whole extent, which is necessary in order to procure a complete evacuation.

If any extraneous body be lodged in the substance of the member, we should examine nicely, in order to know where it lies, and, if possible, without bringing on much irritation to remove it, because its extraction is both necessary, and affords such comfort to our patient, that it will be advantageous in forwarding his cure.

The direction of the blow will nearly indicate the place where the extraneous body is lodged, and the surgeon may endeavour to find out that by introducing a good sized sound, not a small probe, which from its bulk will neither make new passages, nor be stopt by little obstacles: But this is only, I must say again, to form a better judgement about the direction

tion of the blow, and consequently of the place where the ball, &c. probably lurks. However, we must be candid to own, that even this direction is not always a sure method of discovering the bullet; for, the resistance of some bone which it has rubbed against in its passage, may have thrown it from the straight line which it would have naturally followed. The firmness of the skin which the ball could scarcely overcome in going outwards, may do the same; and I have sometimes observed the bullet carrying a piece of buck-skin or cloth before it, plunge into the limb, and not being able to pierce the skin of the opposite side, it has dug out a passage half way round the limb in the ADIPOSE MEMBRANE.

The direction of the shot being found out as near as possible, the external wound must be dilated, and then a finger introduced. The finger, which by the delicacy of its touch, is able to distinguish the crushed from the sound flesh, is the best probe we can use. It serves to conduct the history, and if nothing forbids, to dilate as far as the bottom

of

of the wound, even upon the bullet itself, which otherwise could not easily be laid hold of, because, as we have formerly observed, it is close set in the flesh.

In wounds of the small extremities, such as the hand and fingers, or any part that cannot allow the introduction of the finger, a sound must be used to conduct the bistory.

When the wound is sufficiently dilated, we will be better enabled to remove all extraneous bodies.

When a ball has run through the substance of any limb, it will sometimes lodge itself under the skin, at the place which is directly opposite to the external orifice; so that when we cannot find it in the wound, we should carefully feel the member all round; if we discover it by this means, it is better to make a counter opening for taking it out, than to extract it through its own passage.

A counter opening is also convenient for extracting any bullet that has passed by the trunk of the vessels which nourish the part.

But

But if the extraneous body cannot easily be discovered, it is much better to leave it, than to harrass the parts by searching too curiously.

When the ball is felt by the sound, perhaps some would propose to draw it out with the bullet forceps, as described by some authors.* But supposing it to be possible, the extraction of that body does not exempt us from making the fore-mentioned dilatations, and consequently we ought to begin with them first. But I must candidly say, that I cannot approve of using bullet extractors, so warmly recommended; except in a case where the structure of the parts will not allow of enlarging the wound sufficiently to the bottom.

The woollen or linen rags brought in with the ball, are not so easily discovered, as the bullet itself, by reason of their softness; they are frequently nestled in the interstices of

* Ambrose Parré, Serjt. Surgeon Wiseman, and Brown, gentlemen of distinguished abilities.

adjacent muscles; and if the finger cannot discover them, after proper incisions have been made, we must not distress the parts by too much searching; they may come away afterwards with the suppuration; and this intention will be greatly promoted by the incisions, and counter openings, if there was occasion to make the latter,

In case the ball has met with a bone in its way, that bone may be laid bare, and bruised only. We may conclude that the contusion is slight, if the bullet has not been reflected; and in this case, there will be no bad consequences, provided we unbridle the PERIOSTEUM, as we have sometimes occasion to do the PERICRANIUM, when it is contused. If this be neglected, the PERIOSTEUM may become inflamed over the whole bone; it may suppurate, and give rise to many troublesome symptoms. The wound may be of tedious cure, from the exfoliation of the bone, which, in spite of all the assistance of our art, is sometimes very slow in being accomplished.

If

If the contusion of the bone should be very great, (which we may judge of by the ball being much reflected) we must unbridle the PERIOSTEUM in the same manner; but notwithstanding this, as we have already observed, the contusion of the bone may occasion an extravasation in its substance, some time after, and thus work its destruction.

If a bone be fractured or crushed in a very hard part, such as the middle of the TIBIA, the surgeon will perceive it without any difficulty. In this case, the shock, the tension, and the swelling which may arise, will always be proportionable to the nature of the fracture.

The foreign body may have crushed the bone quite round, or it may have damaged only a portion of its extent in thickness, either from the fore part, as the spine of the TIBIA, leaving that part entire which is towards the SOLÆUS muscle, or the posterior part, leaving the spine of the TIBIA uninjured.

 Besides

Besides it may happen, that a portion of the bone which seems not to have given way to the blow, may be separated from the two extremities of the bone, and kept adhering only by the investing membrane of its internal surface, by the PERIOSTEUM, and by the muscles which are attached at that place, and to ascertain this point, requires much judgement. Farther, it may so happen, that the bone is fractured at the part where the blow was received, and besides that, there may be another fracture of the same bone, at some distance from the former, as I once met with in America. Lastly, the bone may be split to one of its EPIPHYSES, but this is what the surgeon cannot know with any certainty during the first days, notwithstanding the strictest examination; but in a few days after, it will be indicated by two circumstances.

The

The first of these is a redness on the skin, with a moderate swelling along the whole fissure, such as we observe on the head along a fissure of the skull. This redness however, may require a longer time in some than in others before it appears, especially in such limbs as are very fleshy.

The second indication of such a crack in the bone, is, a beginning of the CALLUS, which is perceivable some days after, on the termination of the fissure at the fractured part of the bone; this CALLUS is formed by the nutritious juice that is poured out at the fissure, and begins to harden.

In most of these cases, the shivered pieces of bone having made a laceration at the bottom of the wound, the splinters prick and tear the PERIOSTEUM, or some other tendinous parts; if any rags of the clothes have been introduced with the ball, they most likely lodge there, hooked on the broken pieces of bone; the bullet itself may likewise remain there, and may not be of a smooth

smooth form, as I have in general found balls that had broke bones, flattened and of an irregular figure. All these circumstances taken together, are so many motives that should determine us to make proper incisions, sufficient to prevent the accidents that may threaten the member, to remove the extraneous bodies, and enable us to dress that wound easily, which is deep, and should be kept open a long time on account of the exfoliation that must happen.

When the incisions are made in a proper manner, we introduce a finger into the wound, which, as I have already said, is always the best probe, by which we can easily distinguish whatever is extraneous.

If any splinters are felt entirely separated from the body of the bone, their attachments should be cut, and afterwards they may be removed with great ease. To attempt to pull them out by force, before their adhesions were divided, would be an unwarrantable practice, because this could not be performed without

without giving the patient exquisite pain, which would irritate the nervous system still more.

Any large splinters or shivered pieces of bone that are not displaced, and adhere by a considerable portion of flesh, should be left untouched, because the CALLUS may unite them again. But if their sharp points prick the circumambient soft parts, these points or edges ought to be taken off with a pair of cutting forceps.

But if the bullet strikes any bone on one of its epiphysis, the TIBIA for example, or the radius and ULNA,* in this case the bullet may neither suffer a reflection from its direct course, or break the bone, but dig out a passage for itself, and remain fast locked in the bone. When the ball does not pene-

* History of the case of Mr. William Clark, of the 16th regiment of light dragoons, who received a volley of musquetry, fired from an ambush, when patroling, one ball lodged in his right wrist, another in his right buttock, and another deep in the pectoral muscle of the same side.

trate

trate deep, and if it can be extracted with ease, there is hopes of saving the patient without taking off the limb, provided there happens none of the disagreeable accidents which has been already observed, in consequence of the shock which the whole articulation has suffered, or an unconquerable inflammation over all the tendinous parts that enclose the joint.

But when the ball has penetrated so far into the substance of the bone, as to render its extraction impracticable, or if alarming symptoms begin to appear, we have no other resource but the amputation of the limb.

If a bullet has taken away a piece, or penetrated into the substance of a bone at its spungy extremity, the injury is commonly much more inconsiderable, than if the same accident had happened to the center of the bone, as in the latter case there are always but few splinters,

But the advantage such a wound has over one that is inflicted at the middle of the bone

is

is sufficiently compensated by the havock, which in the former case, is made among the surrounding APONEUROSES of the extremity of the bone,* and the tendons fixed there.

The discretion of the practitioner must guide his conduct according to the exigency of the circumstances; that is, to determine by his judgement, if there is any hope of saving the limb, by making the proper incisions, and if there are none, the sooner he performs the operation, it will be so much the better.

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* History of the gallant Major Ferguson's case, who had part of the olecranon (the elbow) of his right arm shot away, at the battle of Brandywine, North America.

CHAPTER VI.

Of the dilitations, and the mode of staying the hæmorrhage.

AS the cure of wounds, as well as of other diseases, is in reality the work of nature, assisted by art, it becomes the business of the practitioner to study her indications, watch her motions, when she calls for aid, keeping always in mind never to do too much. All wounds, even the most slight, which are naturally susceptible of a cure, become tedious, troublesome, and often dangerous, when improperly managed; and much more so, indeed, must be, by injudicious treatment, those wounds, that are in themselves considerable. We will now make a few observations with regard

to the incisions, or the dilatation, so necessary to be made as soon as possible after a gun-shot wound, which I have already proposed.

They must be deeper, or superficial, according to the exigence of the circumstances. We should not spare the fleshy bodies of muscles, and whenever they are covered with a common membrane, or APONEUROSES, as those of the leg and fore arm are, we must unbridle and cut up that membrane freely, if we would prevent abscesses that must otherwise unavoidably be formed in the interstices of muscles. The fascia of the thigh, must also, not be spared. The same rule should be observed with regard to all APONEUROSES, wherever they be; but then, it must be allowed, they require great skill and circumspection to cut them up in a proper manner.

If they are divided only lengthways, according to the direction of their longitudinal fibres; this incision, I have found by expe-

 rience,

rience, does not unbridle them enough; they should therefore, in particular cases, be cut in a transverse direction also, or obliquely; and sometimes even in all possible directions, like the radiated light of the sun.

In these incisions, we ought to spare the tendons as much as possible, that the motion of the limb may be preserved after the wound is cured. But there are cases, in which the circumstances may be such, that we cannot avoid cutting them; as for example, in the case of a wound with great havock made among the bones of the TARSUS, or METATARSUS; it is then necessary to make incisions on the foot; and others certainly may occur in practice, which we cannot preserve.

But the surgeon's great caution, and attention, with regard to the incisions, should always be to keep clear of the large trunks of vessels, lest the inferior parts be deprived of their necessary nourishment. The smaller vessels, which are only the branches or ramifications

ramifications of these trunks, should never prevent us from finishing the dilatation; but after they are divided, the bleeding must be, if possible, stopt directly.

In surgery, the common means used for staying a hæmorrhage, are stipticks, compression, and ligature. In the case of a gun shot wound, that sort of compression, which is made by cramming up the wound with dry lint, ought to be rejected, because it would hinder, or retard the evacuation which we endeavour to procure by our incisions; and may produce a dangerous swelling on the circumference of the wound. Stipticks need the assistance of compression: they prove efficacious only so far as they make an eschar, and the wound itself is previously too much encumbered with eschars; therefore I would not recommend the use of these applications in every case where a ligature can be made on the bleeding vessel. This latter, in my opinion, should always be prefered to any other method of stopping a hæmorrhage;

hæmorrhage ; because it makes a compression only upon the vessel itself. The great difficulty, sometimes, lies in securing the vessel with dexterity, when the wound is deep ; and that difficulty is owing either to the vessel being so concealed within the flesh, that its orifice cannot be discovered, or else to its deep situation in the wound, or to the great quantity of blood which fills up the wound, and thereby covers the vessel. The depth of its situation in the wound, will be no hindrance, provided sufficient incisions have been made ; and the overflowing of blood will be no longer an obstacle, if care is taken to apply a tourniquet on the upper part of the limb, on the tract of the trunk of the artery. This being done, the surgeon must clear the wound of all the blood which stuffed it up, and hid that part where the opened vessel lies ; then he may pass a needle under the vessel, and make an effectual ligature.

In wounds on the trunk of the body, or in the incisions which we are obliged to make there, it is possible that some vessel may bleed so freely as to require being taken up with a ligature; and the great misfortune here is, that that the hæmorrhage cannot be suspended by the tourniquet, as on the extremities. In this latter case, it is very troublesome to tie the vessel; and yet the ligature is preferable, (if it possibly can be done) to the use of stipticks, as has been already observed.

In order, therefore, to make a ligature here with greater ease, that is, to hinder the streaming blood from covering the end of the orifice of the vessel, we must seek out that orifice with one of our fingers, and when it is found, the finger being kept on the vessel, will stay the hæmorrhage. Now the surgeon must remove all the blood which filled up the cavity of the wound, then with a crooked needle, pass a thread through the flesh at the circumference of the opened vessel, and

cause

cause his assistant to tie the knot without removing the finger, till all this be done. But should the case prove so unfortunate as to make the ligature impracticable, we must have recourse to some stiptick applied directly against the mouth of the vessel, and keep it fixed there with the finger till an eschar is formed. By this method the sides of the wound suffer no compression or cramming, that can occasion inflammation. The eschar being made, the wound is to be dressed softly according to art. It must, however, be remarked, that hæmorrhages will sometimes break out at the time of receiving a wound.

A surgeon who is conversant with anatomy, and has found out the path of the bullet, whether it be in the trunk or extremities, will know immediately what vessel is opened, and where that vessel is situated; consequently he will be able to stop the bleeding with ease, by the methods which we have laid down, especially if there is an opportunity of applying

ing the tourniquet, because that instrument gives him the command of the blood.

He may then at his leisure make proper incisions, and thereby discover the opened vessel. The moderate bleeding of the wound is a necessary consequence of those incisions so often here recommended, but that will generally prove useful in keeping off inflammation, and preventing a swelling from rising on the part; if we stop it by cramming up the wound, we act in opposition to our own designs; the fact is, it will stay of itself in a little time, and requires no other attention than a soft and mild dressing.

If a bullet has passed by some of the large blood vessels, and wounded any of the branches, it is possible *that* wound may not bleed immediately after the ball has entered, though a considerable ramification may have been opened. But we must be upon our guard here, as a hæmorrhage is

to be feared, on the separation of the eschar, and sometimes sooner. It will, therefore, be acting but with proper caution, to place a tourniquet round the upper part of the limb, that it may be ready to be made tight, in case a hæmorrhage breaks out; for, without this precaution, the patient is exposed to the danger of perishing. If the wound be on the trunk of the body, the surgeon who is aware of what may happen, should leave an assistant with the patient, to be in readiness to check a hæmorrhage, in case it should arise.

With regard to the manner of dressing gun-shot wounds, they should always answer the views which have been laid down. We should not blindly follow that practice, which was almost generally received in the days of the old and celebrated surgeons, MAGGIUS, AMBROSE PARRE, and MANGET, &c. of dressing gun-shot wounds, the first time with lint soaked in strong spirits. The application of that liquor will do very well

well on the surrounding parts of wounds, that are complicated, with a proportionable degree of contusion and ECCHYMOSIS, and it may likewise be proper in the case of large contusions, where deep scarifications are necessary to prevent mortification, which might quickly follow, from the great plenitude that is over the whole limb. But I must be permitted to observe, that it can never be useful, but where the soft parts have their sensibility either blunted or entirely destroyed.

But, in cases where we are obliged to make deep dilatations into the quick, spirituous applications should be avoided; because the smarting heat which they excite in these parts, acts directly in opposition to the relaxation which we wish to procure, and they being driers, will be more ready to retard than promote the suppuration. We may observe, therefore, that in all cases similar to the latter, it will be sufficient to fill up the wound with dry lint, proportionable to

its cavity. The lint should be very soft, and then it will be in no danger of ruffling or pressing too hard upon the sides; and if it is applied in sufficient quantity, all the blood or humidities that may be discharged, will be absorbed by it. The rest of the dressing should coincide with the before-mentioned intention, that is, the bandage should not compress the part. If any bones are broken, the member, if possible, should be placed pretty high, to facilitate the return of the fluids towards the center of the body; and carefully fixed, so that the fractured pieces of bone may not play against each other, and this especially, if there is a necessity of moving the patient to any distance. But it must be remembered, that the lint which is put into the wound, imbibing the blood, converts itself into a cake, which sticks very close over all the surface, and when the bleeding is stayed, it gradually hardens with the blood, when this mass of lint and blood stops up the mouths of the vessels, and even

irritates

irritates them by its stiffness, which may bring on inflammation. To obviate this inconveniency, as soon as the wound ceases bleeding, without removing the cake of lint, we should cover it with a pledgit, dipped in warm digestive, in which a little of the ointment of gum elemi is dissolved, and over all, place a bed of warm poultice. This will serve as a digestive for the first dressing. It is sometimes impossible for the most careful and attentive surgeon, to do all that is necessary to be done to the wounded, on the first dressing in the field of action. When time and opportunity will permit, it is attended with the happiest effects to make the dilatations. and even to perform the amputation, if it is requisite.*

* There are no stumps which heal more kindly than those in consequence of an operation from gun shot, when performed early. In the mild season of America, they seldom exceeded a fortnight, before the stump was completely healed

For if the patient must be removed to a distant place, this would be accomplished with much more ease, and he would suffer less pain after all extraneous bodies and splinters have been removed, and after the bones were reduced, and kept in their natural place, or even after the amputation was performed, if a great destruction of the bone should require it, than to convey the patient in his immediate shattered condition; for the jolting motions, which, by the common vehicles he will unavoidably be exposed to, in being moved to some distance, to my knowledge, has occasioned very painful symptoms, and in consequence, convulsions; and frequently, when he has arrived at the end of his journey, the amputation is found to be impracticable, and we had to lament our want of an opportunity to perform it in the first instance.

CHAPTER

CHAPTER VII.

Observations on the dressing of gun-shot wounds continued.

WOUNDS produced by fire-arms, are very different from those made by cutting instruments; as, in the latter, nothing more is required than a re-union of the divided parts, which we can often accomplish in a very short time, especially when the wound is in a longitudinal direction with the fibres of the muscles. But a gun-shot wound cannot be healed up without a suppuration, on account of its eschar. The first dressing of

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a gun-shot wound ought not, therefore, to be removed for at least two or three days. Nothing should induce us to take it off, except a hæmorrhage, or an itching, or an inflammation comes upon the wound. If these accidents then give us no trouble, the dressing should remain, that it may be separated by the suppuration, whether that be of a good, or unkindly nature. By this means we shall avoid giving the patient pain, or perhaps causing the wound to bleed afresh. When matters go on smoothly, without any bad symptoms, the wound must be dressed with the greatest tenderness, with mild, balsamic, and warm digestives, exposing it as little as possible to the air; which element, although the support of life, is a great enemy to all wounds.

Our endeavours must be, to assist nature in every thing, who always wants to do what is right, and struggles incessantly, on her part, to perform the cure.

It is not the medicines which we put into the wound, that will cure it; and, strictly speaking, we may say, that every thing we apply there is an extraneous body, whether it be lint or medicine. It is nature alone that must form the fleshy granulations that fill up a wound, by means of the nutritious juices which ouze out from its sides; and it is her alone that can bring on a cicatrix.

Our business, then, with regard to future dressings, becomes very simple. Supposing, then, that the necessary dilatation has been made, that there is no extraneous body lodged in the wound, that there is no hæmorrhage, and that the first dressing is removed.

It is our next business to assist nature by various means, according to her different purposes, and in the different stages of the disease. When the eschars are softened, the suppuration will be brought about sooner, which, in most cases, may be done with

the simple balsamic digestives, as has been said before. When the PUS becomes abundant, we must put a small quantity of dry lint into the wound, for its absorption, at every dressing. That divine remedy, the peruvian bark, must often be called in to our aid. The fleshy granulations must be gently braced, now and then, by astringent lotions, with which we should moisten the sides of the wound, when they become puffy. Last of all, which shall be repeated once more, care should be taken in dressing, not to leave the wound long exposed to the free air, and to cover it well up; that the external air may not get in, and corrupt the nutritious juice which should form the soft granulations.

But if the ECCHYMOSIS and contusion have been very considerable, the suppuration may likewise be very copious, on account of the great quantity of fluids which have been extravasated round the circumference, and which will now be evacuated by the wound;

and, perhaps too, the suppuration may be bloody. We must expect, in these kinds of wounds, to meet with different kinds of suppurations, which will depend sometimes on the nature of those fluids with which the part was loaded; sometimes on the degree of change which these fluids have undergone, during their state of rest; and at other times, on the quality of the nutritious juice, which is constantly conveyed to the wound. If, therefore, unkindly suppurations threaten to damage the vessels from which they are poured out, which we may know by the figure of the wound, and the quality of the pus, the simple dressings which I have before recommended, will not be quite sufficient; therefore, in this state of the case, we must be under the necessity of using ANIMATED DIGESTIVES; which have a power of correcting the juices, and defending the sides of the wound, against the corruption which might otherwise prevail. It is not necessary to enter into a particular detail of these

 digestives,

digestives, because every surgeon must know them; and almost every author is full of them However, it must be observed, that the application of oils, and greasy medicines, never agree here, after the eschars are fallen. Among these warm and animated digestives, I reckon a little of the spirit of turpentine, mixed with them, as one of its most excellent ingredients, as a topical application, in all cases where tendons, membranes, or APONEUROSES are concerned.

Whenever greasy or putrescent applications are used, in the above state of things, they melt down or attenuate the suppuration, which not only lays all the muscle exposed, as if they had been dexterously dissected, but is very often followed with a reflux of purulent matter.

After the dilatations have been made, and the scarifications, (if they are found to be necessary) these warm digestives will relax the mouths of all the little vessels which are

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in a state of constriction, and animating the load of fluids round the sides, will facilitate their discharge inte the wound.

Wherever there are eschars, these medicines soften them, so that the nutritious juice endeavouring to make its way out by the wound, separates them sooner. A distinction must also be made between the different parts of the same wound, that we may dress each part according to the state we find it in, for sometimes there will be only an eschar on the part which the bullet touched, while the rest of the wound is clear, and wants only to be healed up.

With regard to the times of dressings, they should be more or less frequent, according to the variations of circumstances, the heat of the weather, &c. In North America, during the summer months, where Farenheit's thermometer stood generally between eighty and ninety degrees, I have found it necessary to dress twice, and often three times a day.

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If there has been a hæmorrhage stopt either by a ligature on the vessel, or by stipticks, nothing must be laid upon the wound but fine lint, covered over with a little of the vulnerary powder, in order to retard, as much as possible, the separation of the eschar, or of the ligature.

And at the time of every dressing, great care should be taken to support that band of lint, lest it should suffer any violence, in removing the other things that cover the wound.

What has been just observed, relating to the dressing of a wound, where ligature or stipticks have been used to stop a hæmorrhage, should also be attended to, with regard to every thing that is put into the part; for we should never pull it away before it be quite separated and loose.

But, in the case which has been already supposed, where incisions or deep scarifications have been made, with a view to stop the progress of a gangrene, the simple dressings

ings will no longer answer our intention. The wound, and the surrounding parts, must be frequently fomented with strong spirituous fomentations, mixed with a solution of camphor, sometimes the SAL ARMONIAC, to keep up their life and heat, and the peruvian bark must be administered copiously.

But, again, supposing that nature has seconded the endeavours of our art, then the wound is to be dressed with simple or animated digestives, as its different states require, until the swelling disappears, and the eschars fall off.

Yet, in this last case, as well as in all those we have formerly proposed, we cannot expect to see a suppuration capable of generating good flesh, till after the part be completely disembogued of its plentitude.

This change may be known by the softness of the limb, which has gradually returned to its natural state; by the nature of the pus, which is white and thick; and by

by the look of the rising flesh, which is firm, granulated, and of a deeper red colour than formerly.

In this favourable state of things, we may now lay aside the use of digestives, and all applications that generate pus, substituting in their place, spirituous drying and vulnerary medicines, which has been already observed.

Such applications will be able to brace up the mouths of all the little vessels, and enable them to form true granulations; for without that assistance, the best juices, will very often produce nothing but a flabby soft flesh, which in a short time will sometimes fill up all the wound.

This flesh must not be allowed to get luxurious, it is easily distinguished from good sprouting granulations, by its softness, smoothness, shining colour, and frequently by its bleeding, supposing it be not very considerable, we must destroy it by escharotics.

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In some patients it may be observed to fill up all the wound in the space of twenty four hours, as that kind of false flesh, or fungus, sprouts always very speedily ; in this case the surgeon may remove it with the forceps, or his finger, as he will find it will readily give way. It will bleed a little, but that is of no consequence ; when it ceases, sprinkle it over with the escharotic powder, &c. on the basis from whence the fungus flesh was separated, which will destroy the lax pouting fibres that gave rise to this spungy substance. As soon as the wound begins to be lined with sound flesh, we may then consider it as a simple wound that will soon heal up by using simple dressings alone.

In the course of practice we meet sometimes with the ecchymosis and contusion so large, that very unkindly suppurations will occur, and for the reasons which have been already particularized. If at the same time the fever continues, which is almost always the case,

this becomes another cause of the disorders which seize upon the wound; because there being a continual and mutual communication betwixt the wounded part and all the rest of the body, by this means it has happened, that some of the extravasated fluids have got into the course of the circulation, and there disturb that intestine motion which the Author of nature has imprinted on our fluids, and on the nature of which their good or bad qualities depend. Disagreeable consequences will not unfrequently arise from this cause.

If the tension of the nervous system continues to subsist, and the various tumults it may occasion in the whole economy of the machine, the wound will continue remarkably dry. We know, from experience, that a suppuration is more difficult to be advanced in gun-shot wounds, than in others, on account of their eschars; but there is a wide difference betwixt a wound that only requires some days before it grows moist, and another that continues

tinues dry for perhaps nine or ten, as in the present case we have just mentioned. It is presumed then, that the wound will continue dry so long as the fluids are impeded in their free passage through the small vessels. In this instance, as the bad state of the wound is relative to that of all the limb, and even of the whole body, in this situation of things, it is not the wound alone that requires the surgeon's attention. He must hasten and labour hard to still the tonic convulsions of the nervous system, to correct the antecedent cause, to restore the secretions and evacuations which have been interrupted; indeed, to set nature to rights again, without which, the wound will grow malignant, and the patient may lose his life by, perhaps, a seemingly slight indisposition.

It is well known, that when pieces of cloth or any extraneous body, are carried in by the ball, and left in the wound, the suppuration is tedious, and the wound pours out only a thin serous matter. After some days are expired, that extraneous body commonly raises inflammation, sometimes will form an abcess, and waste all the surrounding fat and membranes.* I have seen these accidents happen more than a fortnight after the wound was inflicted.

About this time, the pain which the patient complains of, and the redness of the skin, indicate the place where the extraneous body lodges, and consequently, where an artificial opening should be made for its extraction.

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* Vide Mr. Serjt. Miller's case, 16th light dragoons. This gallant non-commissioned officer, in charging the enemy, at the battle of Prince Town, in North America, was wounded in the thigh by a grape shot, discharged from a cannon. It unfortunately shattered a pen knife in his pocket, and drove its splinters into the wound.

Should it happen that the matter, which is formed in the cell where the extraneous substance rests, makes its way outwards, by a conduit terminating in the wound, a sound or directory introduced into that sinus, will serve to guide the incision; and the extraneous body being thus dislodged, the wound will, probably, take a favourable turn. The celebrated AMBROSE PARRE, whom we have already mentioned, is not a little remarkable in his mode of treating a wound in similar circumstances.

He gives no direction for making an incision, but proposes the use of medicines, which, to use his own expression, '*have a great virtue or power of drawing out bullets, or other extraneous bodies.*' He thinks, likewise, that the suppuration may work out these substances, and adds, '*that there are other remedies which are possessed of this faculty by putrifaction. such as the dung of animals and leaven.*'

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There is another class of accidents that will sometimes occur from a contused wound, in tendinous parts, that are very considerable; and if they do not always appear from the first day of the injury, it is because these parts being bathed and nourished by lymphatic vessels, where (as every surgeon knows) the lymph circulates much more slowly than the blood in larger vessels, the surcharge consequently requires more time, though it be more easily formed here than elsewhere. And if we enquire the cause of this plentitude, we shall find it in the vibrating tension of the nervous system.

The pent-up lymph undergoes a change of its own nature, and thereby generates an ERYSIPELAS, which spreads over these parts: for the erysipelas is a disease of such parts as are more copiously supplied with lymph, than blood, I mean MEMBRANES, APONEUROSES, &c. and on whatever particular spot it begins, from thence it spreads out, seizing gradually on those parts which

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are of the same texture, and at length reaches the skin, which grows red and somewhat orange coloured.

Then we often see the ERYSIPELAS communicated all along the member, even to the two articulations; which, indeed, happens the more readily, as the ligaments, CAPSULA, and APONEUROSES that embrace these joints, have suffered a shock and agitation at the time when the blow was struck. And the progress of this distemper shews itself generally by the swelling of the articulation, by the pain, and by the redness of the part.

An ERYSIPELAS of tendinous parts, is known to terminate always by discussion or suppuration. But the discussion being the more desirable method, we ought to endeavour to promote that expeditiously, by suitable and repeated bleedings, according as the strength of the patient will bear, and by applying topical emollients and discutients

over the whole extent of the disease ; avoiding always greasy medicines, either upon the indisposed limb, or in the wound.

If the ERYSIPELAS takes the way of discussion, the swelling of the part is observed to diminish insensibly, and the skin gradually returns to its natural colour. The wound after this, cleanses more and more every day. But if the ERYSIPELAS takes not this turn speedily, it degenerates into an inflammation, the swelling rises higher and higher, the APONEUROSES rot, and their corruption diffuses a sanious suppuration under the skin, which may render new incisions necessary to be made.

This sort of corruption, or inflammation, never happens, but at the same time the patient is harrassed with a fever, head-ache, restlessness, and sometimes also, with a looseness of the bowels. If the fleshy parts become inflamed at the same time, the swelling may turn out so considerable in the space of

of twenty-four hours, that the whole body shall participate of it, and the limb may be threatened with a gangrene.

This unfortunate situation of things falls out more especially, when some large bone has been fractured, at the same time that a great many tendinous parts have been lacerated; because, in this case, besides the laceration, there has been an agitation proportionable to the resistance of the bone. Very serious symptoms will often attend this state of a wound, or will soon follow in consequence of it. An acute fever tension of the abdomen, with a suppression of the fæces, followed by inflammation, convusion of particular parts, and unkindly suppurations. Experience has taught us, tha all these disagreeable symptoms, often mtually produce one another, each of them bing reciprocally sometimes the cause, an sometimes the effect.

The agitation communicted by the blow, had first raised a fever; n more accounts

than one, the vitiated fluids which the torrent of the circulation sweeps in, redoubles the fits, and heightens its violence ; then the patient's belly frequently swells up, becomes tense, and even painful, which indicates an inflammatory disposition of the intestines and stomach ; and in consequence of this, some patients are so constipated, that no evacuation can be made, either by stool or urine, while others again fall into a DIARRHÆA, that leaves them sometimes no free interval.

The nature and degree of the irritation is what determines the one and the other of these symptomatick disorders. If the inflammation rises still higher, it is soon followed with a hiccup, because it has reached that portion of the peritoneum that covers the diaphragm ; and this may be soon followed with a light head, and even a delirium.

Happy will it be for the patient if this last symptom is not owing to some of the disease settling with suppuration on the membranes

membranes of the brain, for in such a case, the patient is generally in a hopeless state.

We have often observed a sudden reflux of purulent matter forming abcesses in parts that are a great distance from the wound; and there are many causes which may produce that reflux; such as the inflammation of tendinous parts, the fever, &c. without our being able to prevent it. If this reflux be carried on by the lymphatic veins which run towards any emunctory, and if all the absorbed matter be stopt, there the abcess will be formed, and the patient may recover. But if it be carried on by lymphatics that open into the blood vessels, or by these blood vessels themselves, the purulent matter being conveyed into the stream of the circulation, may fix upon the lungs, or upon the liver. This reflux of matter is indicated by irregular shiverings, followed with violent accessions of a fever, accompanied with clammy sweats, and these cold fits often succeed one ano-

ther very quick, till the unfortunate patient expires.

If the matter be disposed to the lungs, an abcess may be formed there, and when that abcess breaks, the pus is almost always diffused upon the diaphragm. If the disease settles on the liver, one or more abcesses are formed under its exterior coat, and when these abcesses break, the pus is poured out into the ABDOMEN. In short, when the purulent matter in the general circulation, falls upon any part, to which we cannot reach by the assistance of surgery, the patient must be in the most imminent danger.

Such an universal tumult, both in the economy of the machine, and in the indisposed limb, is more than enough to bring the disorder into the wound. For sometimes it will happen that the incisions which have been previously made, afford not always a free discharge to all the fluids which have immerged the limb, then, those which rest long there, grow more and more acrid, and they

they fill the wound with a grey, yellow, or greenish coloured serum, that ordinarily smells sour, but sometimes even cadaverous. We must not expect, therefore, to meet with kindly suppurations in such sort of wounds, till all the accidents be first appeased.

A gangrene, indeed, may quickly ensue, if care be not taken to prevent it, either by fresh incisions and scarifications, as have been formerly recommended, or by amputation of the limb, if it be practicable.

With regard to the other helps which art points out, and to those which arise from a regulation of diet, we can propose nothing in particular, but to repeat venesection, and the mild aperients; in many circumstances, to use cordials with the peruvian bark, quieting medicines, and opiates. Indeed, it must be left to the discretion of the practitioner to regulate and proportion all these according to the emergency of the case, and as the strength of the patient shall require.

CHAPTER VIII.

OF the means necessary to be used with a view to mitigate, or prevent the consequent symptoms, after a gun-shot wound has been inflicted.

IN the preceding chapters, there has been laid down every necessary attention and precaution, that our art, founded upon experience, has established to be the most successful mode of practice, with regard to the wounded part. It will next be the indispensible duty of the practitioner, to use his endeavours to mitigate the symptoms, which may have already appeared; and to prevent others that may

may subsequently arise. The economy of the animal machine being disturbed only in consequence of the blow from a ball by the force of gunpowder. That disturbance would rise higher and higher, if the source of the irritation be not removed or diminished.

We have therefore recommended the necessary dilatations, which, though they may seem useful only to the wounded part, conduce to alleviate the primary symptoms; but these dilatations must often be insufficient, if they be not seconded by a suitable regimen, and by evacuations, that may empty the vessels, and the PRIMÆVIE, (or bowels,) re-establish the secretions which have been interrupted, and supply other evacuations which have been suspended; in short, if nature be not set to rights again.

It is well known, that a PLETHORA (or fulness of blood) of itself, may give rise to many disorders; as our health, in a great measure, depends on an exact equilibrium betwixt

betwixt the solids and fluids of the human body. It is as well known, also, that in a PLETHORA, the circulation of the blood is carried on with a more sluggish motion than formerly, therefore this slowness gives a greater disposition towards a surcharge, the quantity of the secretions being now diminished, and, some of them will often be quite stopt up. Hence there is little doubt, that in such a state, the causes of the surcharge arising from a gun-shot wound, will of course have a more certain and speedy effect.

But, even supposing that the patient is not previously labouring under a plethoric habit of body, yet, the shock and agitation which frequently follows a gun-shot wound, will be sufficient to suspend the laws of the animal economy for a season, and there are evident proofs of this in the SYNCOPES, and other primary symptoms, which, as we have already observed, happen at least often enough, to make us apprehensive, and put us upon our guard against other bad symptoms,

toms arising in the progress of cure, from the same original disorder of the system.

It is presumed farther, that if the patient's stomach be loaded with aliment when he receives a wound, and if he does not throw that up by vomiting, as I have often observed many of the wounded do in the field of action; which I have always found favourable, and to render them less subject to the subsequent bad symptoms. His digestion may be weak for some time, and the ill concocted chyle getting into the mass of blood, will form a heterogenous matter, capable of producing another series of disagreeable symptoms. And here there must be observed, and it should surely be attended to by the intelligent surgeon, the irregularity of diet, and the fatigues which our brave soldiers undergo, during a campaign on active service; their unavoidable intemperance, with their fatigues and watching, all conspire to change the leaven of the stomach, to impair digestion, and to produce a bad chyle. All

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these circumstances considered, they consequently must bring on a habit of body more or less a kin to disease. When a person therefore, in such a disposition of body receives a wound, it is but natural to presume that the disorder which that wound excites, through the whole machine, will quicken a disease, that has been, perhaps, gradually gathering strength in secret, and wanted only a little time to manifest its force.

In order, therefore, to remedy or prevent all these disorders, care must be taken to call in the assistance of regimen, bleeding, sometimes clearing the stomach, and gentle laxative medicines.

An exact regimen becomes very essential in this situation of things; as the patient's digestion is bad, during the continuance of the first ill symptoms, and perhaps while, at the same time he is wearied out with pain. On which account, he must be restricted to the use of light food, such as broths, panada, &c which will serve rather to lay than excite any

any effervescence in the blood. But yet there are some constitutions naturally weak, or languid through fatigue, or perhaps exhausted by a hæmorrhage, where it might be dangerous to order too great severity in diet; and where, on the contrary, nature ought to be supported and invigorated. Much will depend on the patient's former manner of living, and the careful surgeon must be guided accordingly: because all the wounded should not be put under the same diet.

The grand intention to be pursued in the internal regimen and treatment of wounded patients, is to prevent the congestion of blood, and the inflammatory tumor to which the lips of the wound are subject: for, of whatever nature a wound is, either the vessels have been cut, and recede from each other, or they have been dried, lacerated, and as it were, cauterized; in both which cases, the free circulation of the blood is hindered in their cavities, and this blood being able to go

no farther, it is accumulated in the lips of the wound in a large quantity, because it is copiously propelled to the wounded parts. But as the humours are conveyed to the parts, in proportion to the velocity, with which the heart propels them into the arteries, and the quantity of fluids the vessels contain, it is evident, that in order to lessen their usual efflux to the parts, nothing else is requisite than to diminish the mass of blood, either by evacuation, or retrenching, what is necessary to repair its continual losses. For this purpose, venesection will become necessary, and perhaps requisite to be copiously repeated, unless a considerable hæmorrhage has already produced a sufficient depletion of the vessels.

In order to prevent the reparation of the loss sustained by the blood, the patient in such cases, must be kept under a very strict regimen, and as much of his usual nourishment must be retrenched, as is necessary to diminish the mass of blood, without too much exhausting

exhausting his strength ; since, in this case, gross and solid aliments form a thick chyle, and, consequently, a blood of the same kind, which is, of course, less disposed to dissipation, but on the contrary, preserves its usual bulk and quantity.

Therefore, in all gun shot wounds, accompanied with great inflammation during this stage, there must be prohibited, to wounded patients, the use of all solid aliments ; and as great fluidity of the blood as possible, must be procured, in order to favour its dissipation. This intention is answered, as has been already observed, by liquid aliments, such as broths prepared with flesh ; but if it is impossible to refuse solid aliments to the patient, besides broths, he may be permitted to use creams of rice, or new laid eggs once or twice a day, at proper hours. But the patient should by no means be allowed to use such things, as are capable of augmenting either the circulatory, or the fermentative

mentative motion of the blood, and by that means exciting inflammatory tumours in the wound.

For this reason, he ought to abstain from wine, during the inflammatory stage, and only drink a decoction of bread, of barley, or maiden hair, or mallow flowers ; which are liquors very proper to check and abate the too violent motion of the blood.

In order to diminish the too copious afflux of the blood to the wounded parts, it is not sufficient to have diminished its quantity, but proper measures must be taken to hinder the velocity of the contraction of the heart, and, consequently, the violence and rapidity with which the blood passes through the arteries, from conveying in the same space of time, a greater quantity of it towards the wound. For this reason, recourse must be had to venesection, whenever we perceive that the force and number of the contractions of the heart are augmented,or threaten augmentation. But

But as the contraction of the heart is only accelerated in proportion to the augmentation of the fermentative motion of the blood, all the parts of which, are subservient to its contraction; it is obvious, that when in wounds, the motion of this organ becomes more frequent and rapid, the principal intention of the surgeon ought to be, to moderate the fermentation of the blood, and the celerity of the fluids, which produce the contraction of the heart.

Hence as the fermentation of the blood, is only maintained by the equal proportion both of the quantity and size of heterogeneous, and especially of the acid, volatile, and acrid parts which encounter with each other in it, it is sufficiently clear, that this fermentation will be the more violent, the more the saline parts are numerous, large, and of such a nature as briskly to encounter each other. Therefore in order to check this violent motion, whether in wounded or other patients, we must either diminish the superfluous fermentative parts of the

the blood; or take care that only such of them as ought to move be put in motion; or attenuate and divide them, if they are too large and bulky; or lastly, obtund and sheath them up, in such a manner, as that they cannot act upon each other.

There are various methods of answering the first of these four intentions; for we may evacuate the too loose saline parts, which abounding in the blood, excite too violent a fermentation in it, either by urine, transpiration, or stool, according as either DIAPHORETICS, DIURETICS, or APERIENT medicines are employed. And indeed, all these methods, or at least some one of them, must be used, in order to carry off the redundance of fermentative parts, with which the blood is impregnated. But as hot sudorifics, and diuretics, throw the blood into violent commotions, those of a milder class must be substituted, such as small portions of nitre mixed with testaceous powder, exhibited as

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we find occasion, together, with the assistance of mild purgatives, by which we will be enabled to carry off the superfluous saline parts of the blood; for these mild medicines are most proper to check the too violent and frequent contractions of the heart.

The bowels of the wounded patients should be kept moderately open at all times, especially before the commencement of the suppuration; but about this period, caution must be used in administering any internal opening medicines, because the violence of the fermentation so confounds the saline parts with the other principles of the blood, that they cannot be disengaged without great difficulty; and even granting that this might happen, and that these saline parts should be conveyed to the various emunctories, yet the rapidity of the blood's motion carries them off, and hinders their elimination by their excretory organs.

For this reason, attention should be paid daily to open the bowels of wounded patients, before the usual time of suppuration, taking care to use venesection previously, if it has been found to be necessary. There may also be given a gentle purge after the suppuration is completed, although the fever and fermentation of the blood may not be very violent, in order to carry off the heterogenous parts, which might excite these two symptoms, provided the patient was plethoric before the reception of the wound. When they are afflicted with a DELIRIUM, CONVULSIVE MOTIONS, or EXCESSIVE DROWSINESS. I have found also by experience, great advantage from the exhibition of pretty sharp purgative medicines.

The second of the afore-mentioned intentions is answered by abstaining from every thing which can supply the blood with too large a quantity of fermentative parts; such as wine, all spirituous liquors, too strong broths and too heating aliments; in a word by

by abstaining from every thing capable of augmenting the motion of the humours, and more effectually disengaging the saline parts, which float in the lymph, and are obtunded by it. Besides, as violent pains, by the agitations they produce in the nervous fluid, contribute to put the saline parts of the blood into quicker motion, and thus to excite their fermentation, it is expedient for the prevention of this, to alleviate the pains felt in the wounded parts, which intention is excellently answered by narcotics, especially those obtained from opium, or the liquid laudanum, for no medicines are more proper to appease pain, and all those symptoms which generally attend it, such as watchings, diliriums and convulsions.

We ought not to be deterred from this practice, by the ill grounded suspicions which the old practitioners had, and indeed some of the moderns, that remedies of this kind retarded the suppuration of wounds, and

brought on a gangrene, since we are convinced by long experience, in the treatment of gun-shot wounds, that opium accelerates their suppuration, and renders it much less troublesome than it would otherwise be. Besides as has been already observed in the preceding part of this work, and is now again repeated, I have had opportunities of seeing the happy effects of opium, when prudently administered, not only in preventing a gangrene, but in stopping its progress, after it had even begun.

As for the third of these intentions, which consists in dividing the gross or saline molecules, which maintain the too violent fermentative motion of the blood, it is answered by such medicines as DILUTE and ATTENUATE the humours, cooling the blood, and rendering it more fluid, which by the volatile and saline parts with which they are impregnated, divide the texture of the gross sulpherous parts contained in the blood, and by that means

means open a passage for the aqueous to dissolve the saline parts.

We must remind the practitioner, however, to be very careful during the first stage of gun-shot wounds in some patients, not to attribute the excessive fermentation of the blood, which often happens, to the grossness of its fermentative principles; when perhaps, it may depend upon the too great disengagement of those principles, which are no larger than in their natural state; for, in this case, we would have reason to repent our having used too much evacuations, and attenuating medicines, whereas we ought to have used such as CORRECT and INCRASSATE, which last, answers the fourth intention; and to embarrass the saline fermentative parts of the blood, either by remedies, which receive them into their pores; or by such as, in consequence of their vicidity, obtund and sheath them up. For this purpose the peruvian bark*

* Too much caution cannot be used in supplying our army with the peruvian bark of the best quality, as the lives must

must be called in early to our aid, and the patient allowed a liberal diet. The bark by its admirable property, will appease the fever, dissipate the serum, which abounds in the mass of blood, correct the acrimony of salts disengaged during the treatment of the wound, favour the generation of new flesh, and the formation of a laudable cicatrix.

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of our brave wounded soldiers often depend upon the application of that invaluable medicine, and especially when we consider the unbounded liberality of government in supplying, ad infinitum, every article of medicine, &c. for their use.

CHAPTER IX.

Miscellaneous observations, and precepts deduced from experience on gun-shot wounds.

OBSERVATION I.

IN making the dilatations, the substance of the parts ought, as much as possible, to be preserved.

In the treatment of gun-shot wounds, when I advise to make incisions proportionable to the largeness of the contusion, or laceration, which the extraneous body has produced in the substance of any limb, so far am I from being inconsistent with this rule, which

which appears to be the dictate of nature herself, that it is to coincide with her intentions; and purely to preserve the substance of the parts, that they have been recommended in this work.

But I speak if such incisions alone, where there is very little, or no loss of substance, for it is acknowledged, that we cannot save the skin too much. For if the proper incisions are not made in large gun-shot wounds, they will not heal, or, not without the greatest difficulty; and they may even become fistulous. A gun-shot wound, when the bullet has pierced somewhat deep into the substance of a limb, so far resembles a FISTULA, that the bottom is wider than the entrance.

And, as in curing a fistula, we are obliged to make its entrance, or orifice, much larger than its bottom, for the same reason, we can have no expectation of effecting the cure of such a gun shot wound, as is here supposed, except we dilate the entrance sufficiently to convert

convert the whole division of parts into a wide open wound. This large aperture in the entrance of the wound, has great advantages, as has been often observed in the preceding chapters of this work.

The figure, length, breadth, and depth of the incisions, is to be determined from five circumstances. *1st*, The depth and extent of the contusion. *2nd*, The nature of the wounded parts, whether fleshy, tendinous, or bony. *3d*, The depth of the wound. *4th*, The bulk of the limb, whether large or small, fat or lean, *5th*, The number and size of the extraneous bodies that must be, if possible, extracted.

The incisions will soon re-unite, if by their means, together with the use of the internal remedies, all the bad symptoms have been prevented, or appeased; and therefore it may be asserted, that by means of them, we have preserved the substance of the part, which a gangrene perhaps would have destroyed.

It is well known to the author, as well as to many of his colleagues, who served with him during the American war, how many limbs (and even lives) have been saved by these dilatations, which, otherwise, must unavoidably have been amputated.

OBSERVATION II.

WHEN the suppuration of a wound has taken place, the times of dressing ought to be more or less frequent, and are to be regulated by the different states of the wound.

The quality of the pus may be noxious, from a great many causes; and when the eschars are fallen, that vitiated pus may irritate the nervous PAPILLÆ, which sometimes

times occasions considerable pain in these wounds. Wherefore, in this case in a warm climate, we must dress twice, and sometimes three times a day, even when the quantity of pus is not excessive The quantity of pus is another reason for dressing, when there is as much as wets through every thing that has been put on the wound; but if it ouzes not thus through, and if the suppuration is gentle, as when the wound shews a tendency to re-unite, the dressings must be at considerable intervals, that is, once in twenty-four hours; and sometimes, only once even in two days. Under these circumstances, we dress but seldom, to hinder the external air from getting into contact with the surface of the wound, and from vitiating what little pus there is keeping it moist, which we ought to regard as a healing balsam; and likewise to avoid disturbing the fleshy granulations by friction.

OBSERVATION III.

ALL medicines applied to wounds, are either suppurative and promoters of dissolution, spirituous, vulnerary and drying, or escharotic. The suppurative, and the promoters of dissolution, indeed, ought to be used before the separation of the eschars, and when the plentitude of all the little vessels, in the circumference of the wound, has not yet subsided.

Supposing the eschar caused by the ball, to be only superficial, its remaining long in the wound, can do no harm; the dressing need not be removed till two days after. During that interval, it may separate, and when the dressings are removed, we will generally find a suppuration upon the wound. But supposing the eschar is thick and deep, that putrid substance renders it necessary to dress more frequently, at least every day; not so much to renew the medicinal application,

cation, as to send off the putrid steam which the eschar raises in the wound. When this falls off, the quantity or quality of pus will regulate the frequency of dressing.

If the circumstances of any case require the use of spirituous applications, to prevent a gangrene which threatens the part, the condition of the wound requires dressing two or three times a day; both to discharge the cadaverous steam, and putrid serosities, that wet and taint all the dressings, and to renew the medicines But when the wound wants only to be closed over, and we are using vulnerary and drying medicines, the dressing need not be repeated oftener than once in two days, as has been already observed; provided, the quantity of pus is not too considerable, or if it does not grow acrid in the wound, and occasion troublesome itchings there. When we are obliged to make use of some escharotic, the nature of the medicine must determine the proper time of removing that

that dressing, because these applications work their proposed effect sooner or later, according to their activity.

OBSERVATION IV.

THE frequent introduction of a probe or finger into a wound, may occasion many bad symptoms. Any irritation of the nervous system is so ready to disturb the economy of the animal machine, that the all-wise Providence has taken care to cover the extremities of the nerves that terminate in the skin, with a fine carneous covering, or scarf skin, which is extremely fit to defend them against any hard friction: and we may even observe that the scarf skin grows thicker on the feet, and hands of those who walk bare footed, or employ their hands much in laborious work.

Nature

Nature is as industrious in repairing the soft parts, as she has been in forming them; for when the eschar, whether it be deep or superficial, that invested the inside of the wound, is separated, all the nervous PAPILLÆ of that surface, are exposed naked, and consequently excite an exquisite sensation; but in a little time they are covered over with fleshy granulations that are much less sensible. Let us then learn from this, to pay great regard to the nervous system.

If we excite frequent or continued frictions in a wound, by introducing a probe or finger, we must necessarily touch the surface, before the fleshy granulations are constituted; or when those granulations are formed, we will make them bleed, destroy their tender texture, and thereby touch the naked extremities of the nerves. By this means we excite a kind of crisp tension, not only in the nervous system of the part, but also in that of the whole body. Add to this, that the patient

tient cannot endure his wound to be searched without a kind of horror, and even a trembling, which gathers violence in proportion to the degree of scrutiny. If all this does not occasion sudden and capital accidents, as sometimes certainly happens, it at least retards the suppuration, by choaking the small vessels that should furnish the matter. Then this purulent matter is admitted into the stream of the circulation; where it taints the fluids, disturbs the intestine motion which nature has imprinted on them, and which is the characteristic of living fluids; and at length may become the cause even of death. Long and frequent probing of wounds, is therefore, a very pernicious practice; and if the surgeon has made proper incisions at first, such as have been here proposed, he should never search again, without some very urgent necessity. When nature is left to her own tranquillity, she will guide out the extraneous bodies, if they have not been extracted on the first day; and afterwards it may be difficult

difficult to lay hold of them without harrassing the sides of the wound.

What has been here observed, of inconsiderate probing, illustrates the proper method of dressing; which ought to be, almost in every case, very gentle.

The confines of the wound should be wiped, and frequently even washed clean, when the medicine or pus hardens there. It is also proper to absorb the pool of matter in the bottom, with a little dry lint; but the sides or surface of the wound should never be wiped. For, besides that this cannot be done without the risk of making it bleed, the pus which keeps that surface moist, guards it from being in too immediate contact with the lint or medicinal application; and that small quantity of pus, can have no effect in preventing the operation of such medicines, as are spread upon the lint.

Invariable Rule.

If in dressing, a clod or rope of blood is observed at the edge of a deep wound, which we had not been allowed to dilate sufficiently, it must not be taken out. That clod, or that rope of blood, is a proof that some vessel is certainly opened; and the blood has ceased to drivel forth, because the clod which was first generated near the aperture of that vessel, and afterwards gradually lengthened itself to where we see it, has at length closely blocked up that orifice. It operates therefore as a plug, and supplies the place of a ligature; it is for this reason, to be left undisturbed, and even, as much as we possibly can, untouched. If it be in the least pulled, the plug is loosened in some point of its adherence with the vessel, and a gentle dropping of blood ensues. Should it be quite removed, we thereby draw out the plug, and the blood streams freely enough to require being stayed anew, by some of the

the fore-mentioned artificial means. As this vessel lies at a great distance, (for the wound is here supposed deep and narrow, because it has not been practicable to dilate it enough) we must fill up the wound again with dry lint, or introduce some stiptick application, which is equally prejudicial to the well-being of the part, and to the suppuration, which it must either retard, or entirely suppress. What has formerly been said of the various hæmorrhages and bleeding wounds, is applicable only to cases where the wound is sufficiently enlarged, and where we have the command of making a ligature.

OBSERVATION V.

WHEN a wounded person feels a pulsation in the diseased limb, the wound may

be threatened with a hæmorrhage, inflammation, and gangrene. The pulsation of arteries, every surgeon knows, is a beating that is natural to them; but then, it is not commonly perceivable to us, except when we apply our finger directly upon the body of the artery. Whence does it happen therefore, that a patient sometimes feels a general throbbing, or a beating of all the arteries in the wounded member? It certainly proceeds from the great tension in that part; for the laws of motion teach us, that the smallest agitation communicates itself to all the parts of a hard tense body. It is this tension which directly threatens the hæmorrhage, inflammation, and gangrene. The general tension locks up the circulation; and the blood meeting with greater obstacles in returning by the veins towards the center, than in marching out along the arteries, it becomes accumulated in the vessels, and these being surcharged, some of them

them may burst, whence a hæmorrhage necessarily ensues.

The same tension which impedes the circulation of the blood, and especially its return towards the center, threatens also a mortification of the part; since the life of any part depends on the free course of circulation. In another place, the remedies which we must have recourse to under these circumstances, have been already laid down.

But if a hæmorrhage ensues, that is not very considerable, it may sometimes effect a salutary deviation, that shall evacuate the fulness of the part, or at least suspend the progress of the mortification.

When a part that has been swelled several days, in consequence of a gun-shot wound, subsides to its natural size, in the interval between two dressings, without any mitigation of the fever, it is a sure sign of some lurking conflict.

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We have observed, that the swelling ensued and continued in consequence of the inflammation, and of the load of the surcharged or extravasated fluids: it were, indeed, to be wished, that these could discharge themselves completely, by the mouths of such vessels as open into the wound; but this does not always happen. In most cases, fortunately, the greatest part takes this rout; and only a very small quantity is absorbed, which occasions, what we call, the fever of the suppuration and in this case the swelling of the part falls gradually.

OBSERVATION VI.

But from whatever cause it be, if the whole quantity of fluids is suddenly absorbed, in the short space of time between two

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or three dressings, we find the wound almost dry, and the limb reduced nearly to its natural size. Then these fluids, which have not yet acquired their last degree of virulence, continue to ferment in the mass of blood. This is what gives the patient these irregular shiverings, succeeded by a sharp fever, and attended with clammy sweats; which symptoms ever indicate great danger. The peruvian bark, which I shall suppose to have been administered regularly in such a case, should then be continued copiously; even as largely as the patient's stomach will bear.

There is no impossibility in supposing that the quality of the fluids, which are vitiated with some noxious taint, and which sufficient care has not been taken to evacuate at first, (which evacuation we have already recommended) may be the cause of the reflux: but the practitioner may likewise have some share in that case, either if he has omitted

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any necessary circumstance in the method of cure, or if he has irritated the wound by frequent and unadvised probing; or lastly, if he has used improper applications.

Unalterable Rule.

When the surgeon foresees an indispensable necessity of having recourse to the amputation of the limb, after a gun-shot wound, he should never delay, for the shortest time, the operation.

For the amputation may be so visibly urgent, that if it be not put into execution, the patient must soon lose his life.

But it is not with relation to such a case, that I lay down this rule. For the disease may be still free from these capital symptoms that threaten a near impending danger, and the amputation, though visibly necessary, may admit of a delay of some days. In this situation of things, opinions will sometimes

sometimes differ, with regard to the proper time for amputating; though, in reality, there is no room to hesitate. What may sometimes deceive in this point, and may induce a wish to postpone the operation for a few days, is the hope and earnest desire of saving a limb.

We have sometimes, it is true, observed patients that were weak,and in some measure exhausted, recover sooner after an amputation, than such as are strong and of a full habit, but this is not always the case, and should not be a rule for the surgeon's direction.

With regard to the first of these motives, it can never impose upon experienced practitioners, who know, by a single look, whether a wound can be cured without the amputation, or whether it cannot. The second inducement to delay the operation is as ill-founded, as the former; 'tis true, weakness may sometimes be advantageous

to the patient, when it is not owing to a depravation of his fluids; but if these have been vitiated by pain, loss of sleep, fever, and the other symptoms, which necessarily attend every wound which requires amputation of the limb, the weakness, in this case, is an additional bad symptom, and not a favourable circumstance, that will in the least concur to the success of the operation. I speak now from a comparative view of my notes taken during the campaigns in North America.

We should therefore amputate speedily, to prevent the fluids from becoming tainted. This corruption, or taint of the fluids, is the more to be dreaded, as it may prove unconquerable by the most powerful antisceptics; and notwithstanding the plentitude of the wounded part, a communication is still kept up betwixt that part and the rest of the body, as has been formerly observed. In cases of patients whose habit of body may

may render it requisite, it is very easy to bring on such a degree of weakness as is conducive to the cure, by a restricted diet, and evacuations. By such methods, the laudable quality of the fluids may second the salutary interposition of art.

The intelligent surgeon will remark, that the restlessness and inquietude that sometimes attend large wounds, without any apparent or known cause of such a disorder, indicate great danger. This observation is founded on experience. But it can be explained only by reasons that come not up to a full demonstration ; and consequently that may be argued against at pleasure. However it is presumed, that the reason of it may be found in the explication of the following observation.

The inextinguishable burning drought, which is observed sometimes to attend patients, after gun-shot wounds, indicates great danger.

That drought, which is almost always accompanied with coldness of the extremities, is a consequence and indication of prodigious tension in the whole nervous system.

That tension, or crispature, which is a kind of tonic convulsion, choaks up all the little vessels. It is true, that the circulation is still carried on with freedom in all the trunks and larger branches, but it is suspended in all the capillary subdivisions of these, as well in the trunk of the body, as in the extremities, which is sufficiently demonstrated by the freezing coldness that is there perceivable.

We need not wonder, then, if the glands of the stomach, those of the OESOPHAGUS, and all those which serve to moisten the mouth, are inactive, and no longer secrete the SALIVA that should lubricate all these parts.

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The violent and scorching thirst, which is only a symptom in this case is, indeed, at the same time, a proof of the tonic convulsion of the whole nervous system, and of an universal disturbance in the entire animal economy.

As this disturbance is greater sometimes than the power of art can redress; we may therefore look upon the thirst, which is a symptom of that, as indicative of great danger.

Remark,

The convulsive, and palpitating pulse, in a gun-shot wounded patient, is a fatal prognostic.

The convulsive motions observable in the limbs, (of which we have lately treated) are occasioned only by a confusion and irregularity in the motion of the animal spirits. But when the PULSE is convulsive, and palpitates, it happens from the scarcity or absolute want of these spirits, or from their adulteration;

tion: for the motion of the artery is relative to that of the heart; and it palpitates only in proportion to the palpitation of that VISCUS: But this disorder arises in the heart through a deficiency of animal spirits, which cease to flow with their usual current. And as it is the first mover of all the fluids, the whole machine must go to wreck, as soon as it deserts its office.

CHAPTER X.

Of gun-shot wounds in particular; beginning with wounds on the head.

AS in the preceding chapters, the different kinds of wounds that can be made with fire-arms, in general, have been examined, and the means which art prescribes for their cure, have been treated of, it may appear nearly unnecessary to enter into a particular detail of them. But when we reflect on the different

different structure of the various parts, which enter into the composition of human bodies, it may easily be conceived how the wounds that are inflicted on them, must necessarily vary according to their peculiar structure; and thus, that each kind demands some particular consideration in the method of treating them. Wounds of the CRANIUM, for example, are liable to more accidents, than those of the fleshy parts of our bodies; nor are they to be treated in the same manner, and the same is likewise true of most of the others, On this account, it is proposed to examine distinctly, the wounds of some particular parts.

It is conceived, that the indications of cure may be deduced from the structure of the part, without deviating from the general rules that have been already advanced; and nothing farther shall be said of general remedies, these having been, perhaps, sufficiently

ciently particularized in the preceding pages.

A bullet, or any other hard body, which is driven by fire-arms, may strike the head, and only occasion a contusion, without making a wound; or it may also make a wound of more or less extent.

A contusion that is made by the grazing of a ball, and not by a direct stroke, may affect only the soft parts covering the skull, especially if it happens to be on a part that is covered with tolerable thick muscles; such as the temporal, or those which cover the most inferior part of the occiput.

A contusion made upon the temporal muscle, may be susceptible of many bad symptoms, and consequently is extremely dangerous; not on account of the muscle itself, but of the pericranium, which is stretched over it. In the campaign of 1777, in America, an officer, in a duel, received a contusion by the grazing of a pistol ball of an

uncommon size, used on these unfortunate occasions, on the temporal muscle of the left side. Topical discutients, and astringents were applied for three days, having previously used venesection copiously; but the contusion was soon followed with an œdematous erysipelas, which spread over all his head and face, accompanied with a high fever, and he had all the symptoms which attend a commotion of the brain. As there was no time here to be lost, the inflammation and tension of the membrane increasing; on a consultation with Mr. DUNDON, Surgeon Major of the 52nd Regiment, I immediately unbridled the pericranium, by making sufficient scarifications, after which, it was treated as a simple wound, which was healed up in a fortnight by the use of the common remedies. This covering, therefore, of the temporal muscle, requires a great deal of attention, not only on account of its being a tendinous aponeurosis, which

which is tightly braced upon the part even in a natural state, but also because of its close texture, which does not easily allow of the discussion of such fluids as may be effused under it.

Contusions seldom occur about any part of the head that is not covered with thick muscles, which can be ranked of the simple species; for we have frequently observed the symptoms of extravasation upon the DURA MATER, come on within two or three weeks after the blow, where the ball only grazed, and where the hurt was seemingly so trifling, that even the skin had not been torn. The surgeon should, therefore, suspend his judgment, and keep an attentive eye on the least symptoms that may appear, and indicate an extravasation.

If the bullet has struck in a direct line, the bone is undoubtedly injured, however slight the contusion may be; and, still more certainly so, if the contusion is consi-

derable. We must not here dally with repellents and discutients; but proper incisions must be made, in order to examine the condition of the bone. If by the incision the pericranium is found separated from the skull, and the bone consequently laid bare, it is undoubtedly contused; and the operation of the trepan may become as immediately necessary, as in the case of an absolute fracture; for by neglecting it, we run the risk of a suppuration being formed on the DURA MATER, which should by all means be prevented. For the inner table may be fractured, although the outer table appears sound. Besides, it is very possible that the bone may be fractured, even when there is no wound on the teguments, as has happened in a great many instances; and this is an additional reason which should persuade us to make such incisions as are here proposed, in every case, where the ball has struck in a direct line.

Wounds of the head, in the same manner as the different sorts of contusion upon this part, may either not reach so deep as the skull, or they may likewise affect it with the teguments.

A slight wound on the temporal muscle, is as dangerous as a contusion upon the same place, on account of the PERICRANIUM that covers it: I rank it among the tendinous parts, which require to be sufficiently unbridled and dilated, as well in order to prevent the inflammation to which they are obnoxious, as to facilitate the evacuation of those fluids which are effused under them. A wound on any other part besides the crotaphite muscle, even when the skull is not injured, may be attended with troublesome symptoms, if the APONEUROSIS of the frontal and occipital muscles has been contused.

Indeed, all wounds that affect the skull, are of the utmost importance, though they may often appear insignificant,

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And here an opportunity offers for running through all the different kinds of fractures on the skull, to speak of the method of applying the trepan, and of the dressings; but as these subjects have already been amply treated, in various books upon chirurgical operations, we shall refer the reader to them, and content ourselves, at present, with making some reflections that may prove useful in practice.

OBSERVATION I.

THE trepan is not, of itself, a dangerous operation, if it be done in a proper manner; and when it is performed betimes, the patient commonly will recover; if he has suffered no great commotion, if the DURA MATER

MATER be sound, and if no bad symptoms arise from a general ill habit of body, or from the indisposition of some particular part, which may occasion death independently of the operation. We have even seen patients recover, where there has been a considerable commotion of the brain, and others where the injury appeared full as dangerous, even the DURA MATER having been lacerated.

OBSERVATION II.

EVERY contusion of the skull requires the trepan, because it must be attended, sooner or later, with a disorder of the DURA MATER. I have, in a great many instances, observed

observed this membrane suppurate, after a blow which was no more than bruising, where I had found the PERICRANIUM separated, and the bone sensibly discoloured. I have seen the same happen after a blow from a sword,* which had only scooped out a small piece of the DIPLOE, the inner table of the skull remaining entire, without any fracture.

*** During the campaign of 1777, a small detachment of the 16th regiment of light dragoons, reconnoitring about eight miles from Philadelphia, in America, fell in with a company of the enemy's rifle-men, whom they immediately charged with their usual gallantry; several of these were wounded, and the rest made prisoners by our troops,

It happened at this time to be my turn of duty, and Mr. Welford's, an ingenious surgeon in our service, to attend the prisoners of war. Among the wounded brought to the hospital, six were cut in the head, three of whom were fractured, as was visible on the parietal bones.

They were all plentifully bled, and next day their bowels emptied. On the third day we applied the trepan. In two of them the fracture ran so long, with a considerable depression, that it was found absolutely necessary to

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In this doctrine I perfectly agree with all the great practitioners, (viz.) the late Pro-

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ply the trepan three times, to enable us to raise the depressed and broken pieces of the bone, its whole length having suffered from the blow. Considerable pieces of which exfoliated during their cure. The other three prisoners had the scalp cut about three inches, two of them on the left parietal bone, and the other on the right; But, as Mr. Welford and myself could not perceive either fracture or contusion of the bone, we resolved to content ourselves for the present, with using the cooling regimen, and treating them as simple wounds. However, on the ninth day, in the morning, their wounds put on an unfavourable aspect, they had a restless night, were feverish, with other concomitant symptoms, which usually attend on injuries of the DURA MATER. Mr. Welford being of my opinion, to proceed immediately to examine the bone, we began with the patient whose symptoms were most severe.

The bone was no sooner laid bare, when we discovered the pericranium a little loose, and under it the bone felt as if it had been rasped with a file, and appeared a little discoloured, but we could not perceive the least depression or fracture. The trepan was instantly applied, and the DURA MATER found perfectly detached, with a slight suppuration. The trepan was soon after applied to the other two, and

fessor CLEGHORN,* of the university of Dublin, Professor MONRO, of Edinburgh, Mons. PETIT &c. and affirm, that whenever a bullet grazes upon the head,

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appearances found nearly similar. They were all robust healthy young men, and their cures completed in a much shorter space of time, than is usual from such accidents. The cure of the three last was accomplished a long time before that of the former.

* Professor CLEGHORN, this illustrious character was one of the brightest ornaments in his profession, which the last century produced. He had spent the early part of his life in the army, as surgeon to his Majesty's *22nd* regiment of infantry; with which he served some years in Minorca, of the diseases of which island he published an account, that did equal credit to his accuracy of observation, his medical science, and his talents for composition. Having afterwards settled in Dublin, where he practised with deserved celebrity, he was, after some time, appointed professor of anatomy in the renowned university of that capital, second to none in real learning and profound science: and, at the installation of his Grace John Duke of Bedford, as Chancellor of that University, he was complimented by the Chancellor and the University with the degree of M. D.

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so as to lay the skull bare, there ought to be no hesitation in applying the trepan; because after such strokes, we almost alwaya have seen the DURA MATER

The following character of this excellent physician, and truly worthy man, appeared on the Saturday after his death, in the most extensively circulated newspaper in the city of Dublin: which was well known to have been written by one of the most eminent literary men at that time in the University of Dublin, (the Rev. John Robert Scott, B.D.) who was intimately acquainted with the professor; and which character was universally allowed to be perfectly true, and correctly just.

"*Dublin, Saturday, December 26th,* 1789.

On Tuesday last, the *22nd* instant, died at his country seat in the county of Meath, in the *75th* year of his age, George CLEGHORN, Esq. M. D. and professor of anatomy in the University of Dublin. a gentleman wherever known, esteemed and beloved, and wherever heard of, respected. For a series of years supporting with singular honor, one of the most distinguished characters in his profession; he was the first person that established what could, with any degree of propriety, be called a school of anatomy in this kingdom; which long flourished with still increasing splendor and utility under his auspices and direc-

suppurate at the injured part. A remarkable instance of what the author now lays down, happened to the gallant General Harris, (whose brilliant atchievements in India, and the signal services he has rendered to the British empire, will be long remem-

History of the Wound of Capt. Harris, now a General.

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tions, and remains a lasting monument of his industry, spirit, and genius: In his lectures an unstudied flow of natural oratory, clothing his ideas in the most picturesque and animated, but clearest and plainest terms, excited the admiration of every auditor, and impressed his conceptions with irresistible force on the mind of every student. His learning was elegant, extensive, and various. In classical literature he united a correct and delicate taste, to the vigorous judgment of a masculine understanding; and in the sciences, there was none with which he claimed acquaintance, in which he rested satisfied with a superficial smattering, but penetrated into their deepest recesses; an extraordinary sagacity of intellect, and the most retentive of memories, well qualifying him for the task. In his private life affable, social, and friendly; at his table were truly enjoyed, by his select convivial parties, "the feast of reason and the flow of soul."

membered

bered by his country) who, when a captain of the 5th regiment of foot, in America, being warmly engaged with the enemy, was struck by a musquet ball on the left parietal bone; which grazed the bone, and made a wound and contusion, so as to lay the pericranium bare, which felt a little rough, when touched with the finger. Although he was considerably stunned by the blow, he bravely continued

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Whilst his feeling and compassion for the afflicted and indigent were invariably manifested, by the exertion of his superior medical knowledge, and by the aid of his purse. Warm in his friendships he had warm friends; cool in his resentments, he had not an enemy.

Having never been married, his affection and attachment to the nine children of his brother, who had bequeathed them to his care, was truly paternal; and were repaid by them with unaffected duty and reverence, solacing, by their attentions, the decline of his life. Having fulfilled every duty of his station, with honorable integrity and unimpeached credit he has descended into the grave full of years, but fuller of fame.

to

to lead on his company to the charge for some time after, till the enemy were defeated.

Soon after this he fainted, and was carried off the field of action to the first place of accommodation. He was in a little time after plentifully bled, a soft dressing was applied to the wound, and a few drops of laudanum, and antimonial wine were taken by him in the evening.

His rest, that night, was much better than could have been expected; next day, after his bowels were opened, he was much recovered, but felt a shooting pain in the wound. On the second day the dressing was removed; a slight suppuration had commenced, and the part had no unfavourable appearance. As the general was in high health and vigor before the accident, he was again copiously bled, and attention paid to the bowels; his draught repeated at night, and the cooling regimen pursued. Things went on apparently well until the ninth

ninth day, when he became feverish, had a restless night, accompanied with other concomitant symptoms, which attend injuries of the DURA MATER. The trepan was now applied as soon as possible ; when the DURA MATER was found detached and separated from the inner table of the skull, with a considerable degree of suppuration. In a few days after this, his fever, and all his other unfavorable symptoms abated, and this distinguished officer, was soon after restored to his pristine health, to the great joy of the whole British army, being universally beloved and esteemed, by all who had the pleasure of his acquaintance.

From the number of cases of this kind, which I have had opportunities of seeing, during the American war, where bullets have only grazed the skull, I cannot put the gentlemen of the profession, who attend the army, too much upon their guard ; for in consequence thereof, from the ninth to the fifteenth

fifteenth day after the wound, the patients have been seized with bad symptoms, though during the first eight days they had all the appearances of good health.

As these symptoms do not proceed in this case from the extravasated blood, but from the suppuration of the DURA MATER, and as this suppuration comes on gradually; it is not adviseable to apply the trepan on the first day, because then we might find the DURA MATER still adhering to the piece of bone that is enclosed by the head of the trepan.

The battle of German Town, fought on the 3rd of October, 1777, near the city of Philadelphia, afforded another remarkable instance of the effect of bullets grazing on the skull. The gallant Colonel Musgrove, (now a General) of the 40th regiment, had the advanced post of theBritish army, on the morning when the enemy made their attack, and being pressed by the force of their whole

whole army, this distinguished officer threw himself, with five companies of his regiment, into a large stone house, which soon after the enemy surrounded, calling out to him to surrender, or they would set fire to the house; but this heroic officer treated their threats with disdain, and kept up a most galling fire upon the enemy out of the windows, who soon after made several attempts to burn the house, but every man who advanced for that purpose with a match, was immediately killed. The Americans soon after brought four pieces of cannon, and levelled against him, the fire of which, Colonel Musgrove, and his gallant men continued to brave, till he received assistance from Gen. Gray, who with the 3d brigade, and Brigadier Gen. Agnew, with the 4th brigade, attacked the enemy with great spirit. The engagement for some time was very warm. At length, part of the right wing attacking the enemy on the

opposite side of the village of German Town, they soon gave ground, and retired with great precipitation.

They attempted to rally upon some rising grounds, and made a shew of renewing the action; but it was only a feint to secure a retreat. This they effected with all their artillery, under cover of a thick fog, which happened to prevail on that morning, and which rendered it difficult for the British troops to discover their movements.

This fog, which had at first been so advantageous to the Americans, was alledged to have greatly contributed to the disappointment of their scheme; inasmuch as it prevented the different bodies of the American army from discovering each other's movements. During their attack upon Colonel Musgrove, the fire of the 40th regiment out of the windows, coming down in a perpendicular line, made great slaughter among them.

One

One hundred and forty were killed on the spot, besides a great number wounded, mostly all shot in the head.

Among the enemy's wounded from the fire of this gallant regiment, we found ten of the 5th Virginia regiment wounded in the head, by the grazing of bullets upon the skull. The wounds were all in the circumference of the two parietal bones. They were all trepaned in the space of fifteen days. Five of them were trepaned on the 5th day, before any bad symptoms appeared, and we found a suppuration commencing on the DURA MATER in each of them; although there was neither fracture nor depression. The other five were left till bad symytoms indicated the necessity of using the trepan, which made their appearance from the ninth to the fifteenth day, when they were also all trepaned, and the DURA MATER was found detached, but with a more copious suppuration than in the former five. They all recovered and did well.

From the above instances, it may be presumed that the trepan may be applied in similar cases to those of which we have been treating, about the fifth day ; when the DURA MATER generally begins to suppurate.

OBSERVATION III.

IT has been said by some authors, that a large fracture of the skull, is less dangerous than a very slight one ; because, (say they) in the case of a great fracture, the skull gave way to the stroke, and by so doing, broke its force ; and hence it is attended with little or no commotion : whereas in that of a very slight fracture, the skull has resisted, and consequently the whole force of the blow has been communicated to the brain. This

This reasoning is not just, according to the laws of motion, except all blows are supposed to be struck with the same degree of force. Thus it holds not true with regard to small fractures; for a bullet that grazes, may occasion a very slight fracture, or perhaps none at all, without any commotion; and even one that strikes in a perpendicular direction to the head, if it is near the end of its course, that is, what we call a dead bullet, may occasion a very small fracture, without giving any very sensible commotion to the brain. Neither does the former supposition hold with regard to large fractures; for the body which gave the stroke, may have been possessed of such force as to make a very large fracture, and at the same time communicate a very great commotion. It is the practitioner's business to examine all the circumstances, and to collate them with the state of the wound.

In

In every fracture of the skull, the DURA MATER should be sufficiently disclosed, either by the operation of the trepan, or by raising up one or more of the fractured pieces; otherwise an extravasation will be made under the CRANIUM, in consequence of a rupture of some of the small vessels which connect the DURA MATER itself, being torn and bruised; or, lastly, of the contusion of the bone; for a contusion may happen from a ball, even when the fracture is very slight, or even when there is none. It is not for raising the fractured and depressed pieces of bone only, or for evacuating the extravasated blood, that the trepan is applied: it is, in truth, the disorder of the DURA MATER that so often requires it.

In cases where the skull has suffered great havock, as the DURA MATER suffers along the whole extent of the shattered part of the skull, and even to the extremity of every fissure, we should multiply our trepaning, and

and apply one upon every corner, where the state of the fractured pieces does not render it either unnecessary or impracticable to raise them up. I have had opportunities of seeing many instances, where the fractured pieces of bone have been raised out, and where, on that account, it was imagined the extravasated blood would be freely discharged, and proper medicines would be conveniently enough introduced to the DURA MATER: and yet, after all, more of such patients have died than recovered, chiefly from a suppuration on some parts of the DURA MATER, which was discovered on examination after their death. These suppurations, in such cases, were occasioned because the trepan had not been applied upon simple fissures, which communicated by one extremity, with the part from which the fractured pieces had been taken out, but which, at the other termination, were distant enough to require particular attention.

OBSERVATION IV.

IF the bullet that fractured the bone, be not lodged or sunk within the skull, the patient may recover ; but if it is lodged at the least distance behind the inner table, the patient in a few minutes becomes deprived of the intellectual faculty, he cannot stand erect, convulsions come on and continue till he expires For the honor of the profession therefore, let no surgeon ever suppose, that a ball can be lodged behind the inner table of any part of the skull, when the patient, after receiving the wound, can stand erect, and continues to enjoy hisintellectual powers. For if such an idea should be formed, and he proceeds upon this principle to probe, with a view to search for the supposed ball; the probing, alone, may prove the patient's destruction, The nature of the

the fracture, which is either simple, or complicated with a commotion of the brain, must determine the prognosticks, and point out the surgeon's conduct, both with regard to the application of general remedies, and with regard to the operation which may be necessary. But if the ball is sunk and lost within the skull, the wound is always mortal, because of the impossibility of extracting it. I should say that such a wound is always quickly mortal, if we had not in our own times, and that but a few years ago, heard of the ever to be lamented John Mellish, Esq. who was shot in the forehead by a pistol ball, from a footpad, on the Colnbrook Road, and the ball was supposed by his surgeon, to be lodged on the inside of his skull, yet it appeared he could walk erect, and had the proper use of his faculties, and lived some days after. However, it soon turned out that his surgeon* unfortunately

* The late Mr. Rush, who was *an honorable member* of the medical board. As soon as the Duke de

had been mistaken in his opinion, for instead of being lodged on his brain, the ball had rebounded.

Bourbon heard of the accident of Mr. Mellish, and that the ball was reported, by the surgeon, to be lodged on his brain; the noble Duke, from his wonted goodness of heart, and his regard and esteem for a worthy man, instantly dispatched the Chevalier Philibert, (a gentleman of distinguished abilities, who had served in the royal army of France, and was the favorite surgeon of Louis the sixteenth) with a view of rendering Mr. Mellish every service in his power. On the Chevalier's arrival at the Magpies (an Inn on the Colnbrook Road) he immediately declared to Mr. Mellish's brother, that there was no ball lodged on the brain. When Mr. Rush came down again, and the opinion of the Chevalier was made known to him, instead of paying attention to it, or expressing a wish to meet him on so serious a business; he treated the Chevalier's opinion with insulting language.

The highest praise is due to the Duke de Bourbon for his conduct on the above occasion, and the Chevalier's judgment reflects much honor on that nobleman, as well as on the Chevalier himself; who did the author the favor to call on him after his return to town, and related the whole circumstance,—and has since declared, that this unfortunate gentleman fell a sacrifice to ignorance.

Observations

Observations on the wounds of the neck.

SUPERFICIAL wounds of the neck, are of the same nature with all other external wounds; and therefore we shall not take up much time about them.

Deep wounds here, whether the bullet remains, or if it be passed out, are more or less dangerous, according to the nature of the wounded parts, and depth of their situation. The incisions which we have proposed in the general treatise, can never take place here, except with regard to the external wound. The wounded parts that have a deep situation, such as for example, the larynx, wind pipe, pharynx, gullet, os hyoides, and all the fat which surrounds the muscles and vessels of that part, will, considering the difficulty of making proper incisions, be in danger of an inflammatory swelling, which

will degenerate into a quinsey. If that happens, even after all the general remedies have been applied, nothing can appease it however, but the repeated use of those remedies, with the assistance of emollient and discutient cataplasms. Here, as indeed in all other cases, it were to be wished we could take out the bullet, if one should happen to be lodged; but if it be hid in the substance of the part, its extraction becomes difficult, except we run the risk of raising inflammation, which is already too much our apprehension, or opening some of the blood vessels that might bring on a hæmorrhage, which we should hardly be able to stop. All that art can do, after the external incisions are made, is to assist nature with emollient poultices often renewed, and the application of such medicines as will bring on a speedy separation of the eschar, without raising a plentiful suppuration; for that might occasion such a fusion of the matter, as would lay

lay the LARYNX, blood vessels, and muscles all bare.

The abundance of blood vessels which are transmitted along the neck, renders these wounds full of danger, both at first, and afterwards in the progress of their cure. At first, because if any considerable blood vessel has been opened, the patient dies immediately. Afterwards, during the course of dressing, on account of the hæmorrhages which may surprize us every moment.

In these sort of wounds, where the separation of the eschar may cause a hæmorrhage, the surgeon should hardly ever leave the patient, because we cannot keep a tourniquet applied here, as upon the extremities, ready to be screwed tight, if the bleeding should appear. If a hæmorrhage should break out, we must endeavour to find the precise point, whence the blood issues, and, if possible, make a ligature upon the vessel.

The application of stypticks is more useless here than elsewhere, on account of the impossibility

impossibility there is of making an exact compression, to keep them on the orifice of the bleeding vessel.

However, should the ligature be absolutely impracticable, we must apply upon the mouth of the bleeding vessel, a small button, expressed from the most powerful styptick, and support it upon that part by the finger, for about half a quarter of an hour, after which the wound may be dressed, without the necessity of making farther compression.

The most remarkable wound in the neck, which happened during the American war, was that of Captain Hawkshaw, of his Majesty's 5th regiment of infantry, This gallant officer was wounded in the neck, by a musquet ball, which entered the coraco hyoideus muscle, on the right side, passing through and through behind the gullet, which it grazed in its passage. The sufferings of that brave soldier, in the course of his cure, is far above my abilities

to

to express, which he bore with the greatest fortitude. The instant after he received his wound, the blood gushed out in torrents from his mouth and nostrils, and the wound also bled profusely. At first it was feared that the large blood vessels had suffered, but they fortunately escaped from the blow: although the ball had passed within a hair's breadth of the COROTID ARTERIES. An external dilatation was soon made, as much as the situation of the parts would admit, a soft dressing applied, and as soon as was possible, his neck covered with an emollient poultice. Soon after he was bled copiously, although he had lost a large quantity from the wound, and the blood continued to dribble, for two days after, from his mouth and nostrils. In the evening he had a clyster, and towards bed time, a few drops of laudanum, which was got down with great difficulty. He spent a restless night, and as we were fearful of a hæmorrhage, a surgeon

History of the wound of the gallant Captain Hawkshaw.

geon was constantly with him. The next day all his powers of deglutition were impeded, so that he could scarcely get down fluids into his stomach, which was contrived to be conveyed through a small tube by suction: and the same method was used for his anodyne at night. The second and third night was something better than the first, but attended with considerable spasms at intervals. On the third morning the dressings were removed, which came off with ease, from the suppuration which had taken place, and the wound dressed with warm balsamic digestives. The inflammation of the surrounding parts, was very considerable, which had communicated to both the larynx and pharynx. From the third to the twentieth day, matters went on (all circumstances attending this extraordinary wound being considered) as well as could be expected. He was supported solely by fluids, which he sucked down through the small tube above-

mentioned,

mentioned, for the space of thirty days, sometimes cows milk, at other times panada, with now and then a spoonful of wine. About the end of this period, he was enabled to swallow spoon meat, but was reduced to great weakness. The peruvian bark was now administered copiously, and in three weeks more he was enabled to get down solid food. In another fortnight his wound was perfectly healed, and in every respect he was restored to his pristine health, to the great joy of all who were acquainted with the great merit of this brave officer.

Remarks

Remarks on wounds of the clavicle, or collar bone.

WHEN the clavicle is fractured, towards the acromion, by a gun shot, the wound does not deviate in its treatment from the general rule. But if the fracture is towards the STERNUM, the breast may be opened; and if, at the same time, the subclavian artery and vein be lacerated, it is often attended with great danger, on account of the hæmorrhage that may follow, and which commonly happens. The blood will then be effused into the breast, at least if the lungs are not adhering to the PLEURA and mediastinum at their upper part.

Here, as in other cases, we must stay the hæmorrhage if possible, by the means which have been already recommended in general. But if the blood vessels have not suffered from the wound, this has nothing more particular

ticular than other wounds. Whether the blood be poured into the cavity of the breast, or not, no particular rule for its treatment can well be prescribed. In both these cases, when the period of the capital symptoms is over, attention indeed ought to be paid to keep the shoulder back with a bandage; lest the arm should sink in towards the breast, when it is deprived of its ordinary support from the clavicle. At the battle of German Town, Mr. James Rowcroft, a gallant soldier of the 16th regiment of light dragoons, when assisting to clear away some wooden railing, for the cavalry to pass after the flying enemy, who still kept up some fire in their rear, was struck by a musquet ball on the clavicle, near the sternum, which it fractured, with a great contusion. The ball, fortunately, had first hit a thick wooden rail which he held in his hands, by which its force was deadened; or this brave fellow must have been killed on the spot. The bullet fell at his feet,

which was picked up by one of his comrades. He was soon after recovered, and rendered fit for duty, by the usual mode of treatment. I could relate many more similar cases, that happened in this memorable battle, and in other actions during the war; but we shall not take up the reader's time wtth their detail.

Remarks on wounds of the scapula, or shoulder blade.

THE scapula, or shoulder blade, may be fractured in its body, or in its spine; and the bullet may be lodged among the surrounding muscles of the bone, or it may have pierced further.

If

If the ball, from an oblique shot, has broke only the spine of the SCAPULA, we have no reason to be apprehensive of bad symptoms from this wound; provided the surgeon takes care to do what our art prescribes; farther than this, the wound differs not in its treatment from the general rule.

If the bullet has pierced through the body of the SCAPULA, probably some bits of bone, or some pieces of cloth which the ball introduced with itself, may be lodged betwixt this bone and the ribs.

When this happens to be the case, we should make bold incisions, with a view to discover the perforated part of the SCAPULA. For this being one of those parts that are covered with thick muscles, on that account we can make every necessary dilatation, without any danger.

If any large splinters are separated, (which, however, but seldom happens, it is proper to extract them, in order to enlarge the bullet's

let's passage ; if there are only small ones, the hole made in the bone itself is then small, and we have found it sometimes convenient to make it larger, either with the trepan, or cutting forceps, upon supposition that the bullet, or some other extraneous bodies, are undoubtedly introduced and lodged about the SUBSCAPULARIS muscle. If from a neglect of extracting the foreign substances, an abcess be formed under the SCAPULA, which has no discharge by the wound, the pus will spread out under the LATISSIMUS DORSI muscle and there a fluctuation will be sensible. In this case, a large counter opening must be made ; otherwise the pus would soon lay all that muscle bare, and destroy all its connexion with the ribs. If the bullet that pierced the SCAPULA has run into the breast, the incisions, and enlargement of the hole in the SCAPULA are still the more necessary, especially if a rib be fractured. In this latter

ter case, an EMPHYSEMA is much to be dreaded; and the dilatations which we have recommended, will prevent it. Wounds with a fracture of the SCAPULA upon that part whereby it is articulated with the HUMERUS, require the same method of treatment, of which we shall afterwards take notice, on the wounds of the articulations. I shall only observe here, that particular care should be taken to support the arm with a bandage, which may sufficiently bear up the elbow; for without this precaution, the weight of the hanging arm would harrass the wound considerably, by the stretching it would occasion of the capsular ligament and muscles, which are its natural support.

Mr. Pausch, Surgeon Major of the regiment De Knyphausen, of the allied army in America, desired me to see Captain Van Bassewitz, a gallant officer of the above corps, who was wounded in the right SCA-

PULA,

PULA, by a grape shot, fired from a cannon, during the reduction of fort Washington, on the 20th of November, 1776, near the banks of the Hudson's river, in the province of New York. It was on the following day after he had received the wound, that I saw him. The ball had struck him in an oblique line, had shattered the spine of the blade bone, and also fractured its body. The muscles were much lacerated, and appeared all jagged and torn. Although the surgeon had made a considerable dilatation, it was soon found necessary to make still larger incisions. In the space of a month, several splinters of the bone came away with the dressings. An unfavourable suppuration continued to attend this wound for a long time, and seemed to threaten a gangrene: but by the free use of the peruvian bark, and of opium, with a proper attention to the general treatment of the wound, this brave officer was again restored to his health. In

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the space of fourteen weeks he had taken upwards of four pounds of the peruvian bark. Many cases similar to the above might be stated, which occurred during the campaigns in America, but a repetition of them is needless.

Remarks on gun-shot wounds in the breast.

A gun-shot wound received on the breast, may occasion no wound, but only a simple contusion; or it may cause a very considerable contusion, accompanied with a fracture of one or more of the ribs.

The method of cure, here, must be determined according to the degree of contusion.

If there be only a simple ECCHYMOSIS, or if that ECCHYMOSIS be complicated with a fractured rib, this case deviates not from the general practice.

Superficial wounds of the breast have nothing more particular, with regard to their cure, than what we have proposed in the preceding part of these observations. I shall, however, make one remark here, which appears to me to be of great importance, As there is a considerable cellular substance interspersed betwixt the ribs and the great fleshy muscles, such as the PECTORALIS MAJOR, and the LATISSIMUS DORSI, a great fusion of matter is to be feared there, which might be increased by the application of such digestives as tend to promote suppuration. Should this happen, we may sometimes prevent the destruction of these muscles, by making proper counter openings. One or more ribs may be fractured by a bullet, which, being shot in an oblique direction,

rection, did not penetrate the breast, but seemed to have passed under the common teguments only.

The fracture of a rib, it is to be observed, can neither be known by the difficulty of breathing, nor by the pain of which the patient complains; but from the direction of the shot, from a crackling noise which is sometimes perceivable by the ear and touch, and from the prickling pain which the patient feels at the part itself. In this case, the PLEURA may have suffered a less or greater laceration, and an EMPHYSEMA may come on soon after. In such cases, it is not enough to enlarge the two orifices of the bullet, by incisions; but if we would prevent a great number of dangerous accidents, which such a fracture may give rise to, we should, without farther hesitation, lay that place open where the rib is fractured. By this method an EMPHYSEMA will be prevented, by this method abcesses will be avoided, the pus of which would be poured into the breast, and

separate the PLEURA from the ribs: by this method we facilitate the extraction of bony splinters, which might occasion abcesses, if left in the wound; and we have an opportunity, likewise, of taking out the pieces of cloth, which may have remained entangled upon the inequalities of the ribs. Besides if the lungs were in adhesion with the PLEURA at that place, we will by this method, prevent their inflammation and suppuration.

When the shot penetrates into the cavity of the breast, and the extraneous body is either lost there, or passes quite through, a rib may be broke on the side where the bullet entered, or on the side where it made its exit; and this accident may, likewise, happen to each of the sides at the same time, as I have had opportunities of seeing occur during the war in America. Lastly, there may be an extravasation of blood, or there may be none. The fracture of the

rib,

rib, the injury inflicted on the internal parts, and the effusion of blood, when such an accident is produced, deserve, each of them, particular attention. The external wounds, or orifices require proper incisions, especially that where the ball entered, if a rib be fractured; because here the points of the broken bone are turned inwards. Supposing the situation of the wound to be low enough, it may facilitate the discharge of whatever may be effused on the diaphragm. With regard to the internal wound, if the foreign body is gone, having passed through and through, we can lay down no particular direction, but to endeavour to prevent inflammation, by pursuing the cooling regimen, with the use of the common remedies; and to throw the cure of re-union upon the powers of nature.

If the effusion of blood, or pus, when this is formed, cannot be evacuated by the wound itself, after we have dilated it, an artificial

counter

counter opening must be made ; this is what is commonly called the operation of the EMPYEMA. We shall say nothing about the manner of performing it, it being a well known operation, of which many authors have written ; but I think myself obliged to offer some reflections on the proper time for making that operation, and upon the method of dressing.

If the effusion be blood, and if that flows from an opened intercostal artery, we must begin first to make a ligature on the artery, and thus block up the fountain from whence the blood streams. Then the EMPYEMA may be next performed. If the effused blood springs not from the intercostal artery, probably it comes from some internal vessel which has been opened by the extraneous body ; and though we know the place where the opened vessel lies, there is no possible method of introducing the ordinary helps, which surgery directs for stopping the hæmorrhages.

hæmorrhages. In the mean time, before we think of evacuating what is already effused, we must first dry up the source : Let us then see if the effused blood itself be able to effect this point. We know the blood which flows from an opened vessel, forms a little clod near the mouth of that vessel; and if that clod be increased so as to come nearer, and at length into the mouth of the vessel, the bleeding will be diminished ; but at last, when the clod becomes glued to the inside of that orifice all round, the bleeding will be entirely stopt. But we know the hæmorrhage will return, if this clod separates suddenly from the vessel. Upon this principle it is presumed, that except the difficulty of breathing, occasioned by the effused blood, be insupportable, we must not be too forward in evacuating that effusion ; and when we can no longer dispense with it, we must take off so much only as will give the patient some ease, lest the clod, or plug should be

separated

separated from the vessel, either by its own weight, or by the motion which necessarily attends respiration. The same reason which induces us to delay the operation of the EMPYEMA till a certain period, and when we come to it, not to make a complete evacuation of the effusion should serve as a rule both for the times of dressing, and for allowing only part of the effused blood to run out at each time.

At length, when the difficulty of breathing does not increase for the space of several days interval between the dressings, it is a proof that the bleeding vessel is now stopt up.

Then all the effused blood changes into pus, and we observe it gradually losing its red colour, as it is discharged from the breast. In a short time after, the eschars, and all the clod of blood which is not within the vessel's mouth, separate and come away insensibly. Frequent dressings would now be hurtful; and it is almost always enough

to

to dress once in two days, with a view to give time to the maturation of pus, and not to be apprehensive that the PLEURA, or surface of the lungs will be vitiated by the contained matter. We should always take particular care to hinder the admission of air into the cavity of the breast, both at the time, and during the interval of dressings.

The surgeons of the allied army in America, made use of a narrow linen rag in dressing these wounds, somewhat like a seton, one end of which they introduced by the wound into the breast. But I did not see that any advantage was reaped by this practice; but rather the contrary: For we not only run a risk in introducing it, of separating the PLEURA from the inside of the ribs, or at least of disturbing that membrane, but farther, that seton in the breast is, truly, an extraneous body. Wherefore, we should use nothing but a stopple of lint, wrapt up in a piece of fine soft linen, and kept firm by

an adhesive plaister laid over, which will confine the stopple in the orifice of the breast and at the same time hinder the admission of air, when the patient draws his breath.

The remaining part of the dressing has nothing particular in it. Some authors have recommended injections to be thrown into the breast in such cases, and I shall here offer my reasons why I have not mentioned them.

The dilatation of the lungs, is barely a passive motion, with regard to the lungs themselves; and if this viscus, in inspiration, is dilated to receive air into its cavity, it happens so, because the lungs are under a necessity of keeping pace with the motion of the breast, which at this time has its capacity every way enlarged. Consequently, if there is a wound of one side or other, which penetrates the breast; when the chest is dilated, the air rushes in by the wound, betwixt the PLEURA and lobe of the lungs which fills that side, whence this lobe is not dilated.

dilated. This being granted, suppose a penetrating gun-shot wound of the chest, it is presumed that injections into the cavity are not only useless in this case, but even hurtful. For while we are throwing in the liquor, and making it run out again, the dilatation of the chest is in vain, the air rushes not into the lungs of that side, but only betwixt the PLEURA and external surface of the lungs. Wherefore, this side of the lungs remaining inactive, during the whole time that is spent in such dressings, the circulation of the blood is there impeded, which may cause new surcharges, and produce a new series of disorders.

Such are my reasons, and they are founded upon practice, for prohibiting the use of injections, which always require a deal of time. In the cure of all wounds inflicted on the breast, whether they penetrate, or not, whether the lungs are wounded, or not; whether there is, or is not, a hæmorrhage,

we should, by means of a pretty tight bandage, in some measure check respiration; that is, hinder the chest from dilating so much as it would naturally do, because the wound itself will necessarily be dilated in every inspiration, proportionably tc the dilatation of the chest.

When a bullet has pierced the lungs, and and passed out again, the patient may recover, as I have seen in many instances:* but

* At the battle of Brandywine, fought on the 11th of Sept. 1777, in which the Americans suffered considerably. Four hundred were killed, and six hundred wounded left on the field of action, and near four hundred taken prisoners; they also lost several pieces of artillery. The loss on the part of the British was by no means in proportion to that of the enemy.

Not above eighty were killed, and two hundred and sixty four wounded.

The first batallion of British grenadiers, in storming the enemy's works, had seven brave fellows shot through the lungs. The balls passed through and through: Five were shot through the right lobe, aud two in the left. The five former recovered, but the two latter died.

but

but it is nature alone that must cure the wound here, as well as those of the other VISCERA; and in order to promote her operation, the surgeon should prevent or appease the inflammation, as has been formerly observed. But if the ball has penetrated a considerable way into the lungs, and rests there, probably the patient will die, because we can have no hopes of extracting it. There is only one case where this may be done, or indeed where we should attempt its extraction; I mean, when the lungs adhere to the PLEURA at the wounded part, and when at the same time the bullet can be felt by the round smooth end of a large sound.

The eschar which is along the whole passage, allows of introducing the sound so far, without any danger of irritating the lungs; and perhaps it will likewise allow of seizing the bullet with a scoop or pair of forceps; because that eschar is a covering of defence, without

without any sense of feeling: and supposing the operation which we now recommend, should cause some degree of irritation, yet still it will do less harm, than the bullet would do remaining in the lungs. In this case it is necessary that the external wound should be sufficiently dilated, that the surgeon may proceed with ease, and meet with no obstacle in his operation.

Among the wounded of the enemy, left in the field of action, after the battle of Brandywine, we found three with the bullets lodged in the lungs; two were in the right lobe, and one in the left. Mr. Bowman, surgeon of the 26th regiment, and myself, succeeded in extracting the balls from the two former, but the latter was impossible, who soon after died, the other two recovered.

With regard to the dressings, they should not here, as in wounds of the external parts, introduce such topical medicines as will promote

promote the suppuration of the eschar, and destroy or correct the false flesh which may shoot up. It is true, indeed, when the lungs are in adhesion with the PLEURA, and the eschar still subsists, proper injections may be used, without any fear of their being effused upon the diaphragm; but when the eschar is fallen, these injections would excite the patient to cough, and thereby cause a dangerous irritation.

On which account, at this time we must rest satisfied with pouring in a few drops of some suitable balsam. On the 20th of September, after the battle of Brandywine, intelligence was received by the Commander in chief, that the American General, Wayne, had concealed himself in the woods on the left wing of the army, with fifteen hundred men, with an intention of harrassing the rear of the British army on their march to Philadelphia. General Gray was accordingly dispatched at night to surprize him.

The

The British General proceeded on this expedition, with great secrecy and dispatch, with two batallions of the light infantry, and a small detachment of the 16th regiment of light dragoons, and in order that the surprize might be complete, he gave strict orders that bayonets alone should be used, and that not a gun should be fired. This manœuvre had the desired effect. General Waynes' out-posts were surprized about one in the morning, and the British troops rushing immediately on the enemy's encampment, made a dreadful slaughter. Three hundred were killed and wounded, and one hundred taken prisoners. The rest contrived to make good their retreat with the loss of all their baggage. On the part of the British the loss was merely trifling; one officer was killed, and six privates were wounded. The skill and energy of General Gray were very conspicuous in this enterterprise.

Among

Among the wounds received in this action, the author particularises one received by Mr. Thomas Vincent, a gallant soldier of the 16th light dragoons, who received a shot through the right lobe of his lungs. The ball entered between the fourth and fifth rib. The muzzle of the musquet, he informed me, almost touched his breast, and the blaze of its fire had burned the lapel of his uniform, which was visible when I dressed him.

The wound of Mr. T. Vincent, 16 Reg. Lt. Dgs.

A feather bed was procured as soon as possible, on which he was laid, and carried to our encampment: His wound bled profusely, and the edge of the rib where the ball had made its exit, was fractured. On the 22nd the whole army began their march towards Philadelphia, at about thirty miles distance, where we arrived on the 25th of September. During the march, this brave soldier suffering under a desperate wound, was carried on a couch, in which the

feather bed was placed, till we arrived in the above city; for the jolting of any kind of a vehicle, in all wounds of the lungs, should always, if possible, be avoided; as the agitation is attended with the greatest danger. And here it becomes my duty to pay the just tribute due to the Hon. Colonel Harcourt,* for the great attention that was paid by him to this brave soldier, as well as on all occasions, to every other man who suffered from wounds or disease in his regi-

*This distinguished officer, now a General, and brother to the noble Earl of that name, is as remarkable for his care and attention towards the health and comforts of his men, as he is eminent for all those virtues, which adorn civil and military life. During the memorable campaigns in North America, where he ably served his country, the sick and wounded soldier, the widow and the orphan in him never wanted a friend and comforter. It was his chief pride to visit the hospital of his own regiment, to see the brave men who were wounded under his command; and his own private purse was always open to supply it with every necessary.

ment.

ment. In the space of ten weeks he had the good fortune, by the means recommended in this treatise, to recover, and to be restored to his pristine health, fit for duty, and I felt myself highly gratified by the confidence which the Hon. Colonel Harcourt was pleased to place in the small portion of abilities which I possess. My feelings upon this occasion, after his recovery, were far above my powers to express.

The wound o
Mr. J. Irvin
16Reg.Lt Dgs

The next case I shall beg leave to state, of a recovery from a singular shot in the body, is that of Mr James Irvin, of the 16th regiment of light dragoons. On the 30th of October, a detachment of the above gallant regiment, were dispatched in the night, about twelve miles from Philadelphia, to surprize a corps of the enemy's light horse. Major Gwyn, of the above regiment, conducted this enterprize with his usual gallantry. By the dawn of the next day, he surrounded the enemy, who were quartered in a large stone house. The enemy kept up a

heavy fire for some time on the 16th regiment, out of the windows. During this action, James Irvin received a shot by a musquet ball, which coming down in a perpendicular line, from the third story of the house, struck him between the seventh and eighth rib on his right side, where it entered and lodged in his body.

As there was no surgeon with the detachment, it was near four hours before he got assistance, on his return to Philadelphia, when I dressed him ; but could not discover any thing of the ball. He was soon after bled copiously, his bowels opened by a clyster, and he had an opiate at bed-time. During the night he made a large quantity of bloody urine. Next day several gentlemen of the profession attended to see this case, which it was supposed would prove mortal: he was again bled largely, the clyster repeated in the evening, and his opiate at night. Large quantities of blood

continued to come away with his urine all this night and next day. On a consultation with Messrs. Bowman of the 26th, regiment, and Mr. Pott of the 42nd regiment, I bled him again to twelve ounces, which, including the two former bleedings, amounted in the whole to forty ounces. The following night was more composed than the former, and his urine was not so much loaded with blood. The above gentlemen were of opinion his bowels were wounded from the direction of the ball; but this proved fortunately otherwise; although the bullet had undoubtedly got in amongst them, which was found to be the case, after his recovery, but it had not injured them. On the seventh day he began to take the peruvian bark, which I ordered to be given to him in warm cow's milk, which served both as nutriment, and contained also, the virtues of this admirable remedy, which agreed with him remarkably well. On the 10th day his urine continued still to

be

be a little tinged with blood, but on the 15th day it assumed its natural colour, and continued free from any more appearance of blood. The external wound was dressed in the usual manner, and the bark persisted in till his wound was healed over, which was completed in the space of ten weeks. For twelve months after, every now and then I made it a point to enquire about his health, which continued perfect in every respect, except when he rode fast on horseback he then informed me that he felt a great weight and pain in his bowels, so that he could scarcely keep on his saddle, which rendered him unable for active duty. I had no doubt, from this circumstance, that the ball had passed down among the intestines. When the regiment returned to England, General Harcourt with his wonted goodness, recommended him for the pension.

Observations

Observations on wounds of the jaws and tongue.

IF a musquet ball pierces the body of the upper jaw, it may remain here locked among the broken pieces of bone, or it may pass quite through, as I have seen happen in many instances. When the ball remains in the bony substance of the upper jaw, in such manner that we cannot discover it, and the patient is happy enough to recover, the wound in general continues fistulous. If the bullet has passed through the bones of the upper jaw, as far as the opposite side to where it entered, but has not gone quite out, sometimes it may be sensible to the touch, by the inequalities which the broken pieces of bone make, at the place where the ball should have

made its exit outwards; in this case a counter opening is necessary for its extraction. If the ball has pierced through and through, I have seen it happen that there was no great havock produced, on account of the rapid motion with which it was carried, together with the softness of the resisting bones: And I have observed some of those wounded in this manner, cured in a very short time.

When the cure proves tedious, it is because the inflammation spreads over all the investing membranes of the bony cells and sinuses. If that yields not to bleeding and the other suitable remedies, the patient will be carried off.

In some of these wounds, I have seen the inflammation of the temporal muscle, and of its tendon bring on convulsions; which, whenever they happen, we must endeavour to prevent or appease by general remedies, and by emollient and discutient poultices.

Should

Should the wound communicate with the mouth, the copious SALIVA which flows from all the salivary ducts, is admitted into the wound, and the pus from the wound flows reciprocally into the mouth; thus the patient will be teazed with the taste of pus, and with an insufferable nauseous smell, if care be not taken to prevent these, by frequent detersive and spiritous gargles, or by injections often thrown into the patient's mouth, when he cannot gargle himself. If one, or both cheeks be pierced, and the loss of substance considerable, the wound may remain fistulous, notwithstanding all the care which the most ingenious surgeon may have taken to bring its lips together, and thus to assist nature, who endeavours at a re-union. If the fistula be only occasioned by an opening of the salivary duct, from which the saliva flows incessantly, especially when the patient eats, the surgeon should manage the business according to the various circum-

stances, so, that the wound may remain fistulous only towards the inside of the mouth; and should labour by proper methods to heal up the external orifice. When the lower jaw is fractured by a ball, besides the treatment which we have proposed in the preceding chapters of this work, the fractured pieces must be kept in a right position, by the chin sling, or some other suitable bandage. In fractures of either jaw, I have seen some cases in the American war, where the broken pieces have been sufficiently kept in their places by tying the teeth, that were still fixed in their sockets, together.

With regard to the wounds of the tongue, it may be said in general, that they are easily enough cured, because this being a muscular part, and not covered with an adipose membrane, it is less susceptible of swelling and inflammation. Wounds here, however, are not always free from accidents, upon account of the membranes which connect

nect the muscular fibres ; and more especially upon account of the dense texture of the skin that incloses the whole, and which is the organ of taste.

If the tongue, therefore, should begin to swell, and indurate, the skin which invests it being incapable of giving way to the swelling, will quickly bring on a gangrene. On which account we ought betimes to make one or two longitudinal scarifications, of a sufficient length and depth into its muscular substance, otherwise the patient would be lost in a very little time.

In wounds of this kind, we should take great care to find out the extraneous bodies, which are often much concealed, on account of the substance of the mouth.

These bodies are either the bullet itself, a detached piece of bone from the jaw, or a tooth. It is nature alone that dresses these wounds with her saliva ; and the detersive injections which the surgeon applies, serve

only to keep the wound and mouth clean; for their stay there is not of sufficient duration to produce any other effect.

In the mean time, the surgeon should treat the external wound, either where the ball entered, or where it passed out, in the manner which has formerly been observed.

Remarks on wounds of the mediastinum, diaphragm, and heart.

GUN-shot wounds that have injured the MEDIASTINUM, are extremely dangerous, because this part is of a membranous texture, and very much subject to inflammation.

As this membrane is stretched out in the middle of the breast, connected with the sternum

sternum forwards, and to the VERTEBRÆ of the back on the posterior parts; its inflammation causes exquisite pain, with great difficulty of breathing.

Our art can do but little towards the cure of these wounds, except by applying such general remedies, as we have already recommended. Should an abcess be formed in the duplicature of this membrane, in consequence of inflammation, which abcess we may know is forming, by the common symptoms of a suppuration; or if it has already formed, and if the oppression increases, even while the fever declines, it will be a difficult matter to evacuate the pus. If we can judge from the situation of the pain, or œdematous swelling upon the sternum, that the collection of pus is immediately under, we may apply a trepan upon the bone, in order to procure a discharge of the matter: But if favorable circumstances do not occur towards the operation, the abcess will open into the breast,

breast, produce an empyema, and notwithstanding all our art, will destroy the patient. It is scarcely necessary to speak about gun-shot wounds of the heart, as they are all fatal; and if the patient expires not immediately, by an opening made into one or other of its ventricles, he will die soon after by the inflammation of this viscus.

There has been some instances of persons living some days after a wound inflicted by a sword, which pierced only into the substance of the fleshy fibres that compose the heart; but if the wound be gun-shot, the patient's death will be more sudden, on account of the shock and perturbation which always attend such a wound.

With regard to a gun-shot wound in the diaphragm, it may either affect its middle tendinous portion, or its outer fleshy part. Both these wounds admit of cure with great difficulty, not only because the diaphragm cannot be pierced by a bullet, except some

of

of the other VISCERA be also wounded, but likewise because of the constant motion to which this part is subjected, for we know that rest is necessary to the formation of a CICATRIX upon any part. If any of these wounds may be cured, it is such as are made on the fleshy part: For those that affect the middle tendinous portion are always mortal; they bring on very sudden convulsions, and even a delirium. These wounds frequently occasion a HERNIA of some of the parts that are contained in the belly, whether of the cawl or intestines, part of which has been sometimes pushed up into the breast. The surgeon's hand can be of no service here with regard to any operation; and nothing but nature herself, assisted with general remedies, is able to cure wounds of this nature.

Remarks

Remarks on wounds of the sternum, or breast bone.

THE STERNUM, or breast bone, may be fractured by a shot, when there is no wound, but only a strong contusion of the integuments; or it may be fractured and laid bare when the integuments are wounded. The treatment of a considerable contusion upon the STERNUM, even when complicated with a fracture, deviates not from the general rule. The incisions that have been hitherto recommended, may be more requisite here than elsewhere, with a view to discharge the soft parts of their load of fluids, and to prevent spreading suppurations among the investing fat and membranes of this part. For by these suppurations the fractured bone might be laid bare, and at length become caries.

Some

Some authors have taken notice of this accident, particularly Ambrose Parré, b. 2nd, c. 6th, but they have given no directions for incisions to prevent it, which is undoubtedly the best means to avoid the most serious consequences. After the necessary incisions are made, nature will re-unite the divided parts, if she is favoured with rest.

With regard to the internal contusion, which is almost inseparable from a contusion on the outside, there is nothing but the application of general remedies, that can obviate the formation of abcesses in the cellular substance that connects the PLEURA with the STERNUM, or in the duplicature of the MEDIASTINUM.

When there is a wound with fracture, and when the STERNUM is exposed, nearly the same method of practice must be observed as in fractures of the skull; that if there be any splinters, or pieces displaced and separated brom the bone, they must be taken

out; or if such pieces are sunk in, and depressed, they must be raised even by applying the trepan for facilitating this work, if it cannot be accomplished by other means. In the case of a simple contusion, as well as that of a fracture, an abcess may be formed betwixt the PLEURA and STERNUM; this misfortune will discover itself by the characteristic signs, which we have formerly laid down on the wounds of the MEDIASTINUM; and the surgeon should examine the circumstances with great attention, that he may give a discharge to the matter, if necessary, by applying the trepan. If the STERNUM should become caries during the treatment, there seldom happens a sensible exfoliation; we must extirpate all the vitiated part with a raspatory, or exfoliating trepan; and as the STERNUM is of a soft spungy texture, whatever we thus expose will be covered over and heal, provided we apply only spirituous or drying topical medicines, and avoid every thing that is greasy or promotive of pus.

Observations

Observations on wounds of the spine, or back-bone.

A Gun-shot wound inflicted on the body of the spine, or back-bone, in whatever part it may be, betwixt the first VERTIBRÆ of the neck and os SACRUM, are all mortal, if at the same time the spinal marrow has been lacerated; for every part that is furnished with nerves from the spinal marrow, must sympathize with it, in every injury: And of consequence, the patients turn paralytick in all the parts that are lower than the wound. A commotion alone, of the spine, occasioned by a simple bruising stroke, may be productive of the same accident. The transverse and spinal processes may be fractured, and the body of the spine not injured; and even when the vertebral artery is divided,

these wounds are included in the general rule: On which account we shall not descend to particulars, but only observe, that in making the necessary incisions, we must not spare the tendons, which are very numerous here, and not let them prevent us from making a sufficient dilatation.

Remarks on wounds of the lower belly.

A considerable contusion upon the lower belly, seldom happens without a wound at the same time, because this region being soft almost in its whole circumference, any hard body either of a spherical or angular form, that strikes it with the ordinary force communicated by gun-powder, must unavoidably pierce

pierce it. If ever a great contusion, therefore, happens in this place without a wound, it must have been produced by a blow, from some flat or broad surfaced body; which, indeed, may sometimes happen. In this case, the external contusion demands not the surgeon's attention so much, as the injury of the internal parts which have certainly suffered.

The surgeon's attention, which we have just mentioned, should consist in prescribing a regimen more restricted, as the VISCERA that serve digestion, and the distribution of the chyle, are now contused: This attention must consist also in bleeding the patient, according to the exigency of circumstances; in giving vulnerary drinks, and by applying discutient fomentations over the whole belly; indeed every thing must be administered that can prevent a surcharge upon the part, and facilitate the dispersion of extravasated fluids.

It is unnecessary to say any thing of such gun-shot wounds as penetrate farther than the integuments of the ABDOMEN.

The treatment of those that pierce into its cavity, without wounding any of the VISCERA, even when the bullet is lost there, deviate not from the general rule, and much less those where the ball has run quite through. We may only observe, that a rupture may be occasioned by the wound. When the wound is large, we almost always see a bundle of the intestines or EPIPLOON fall out, and when the wound is narrow, we have often observed the intestines intangle themselves, during the interval of dressing, betwixt the PERITONÆUM, and such things as are stuffed in the wound, which may expose the patient to violent cholic pains, till these intestines are again reduced. The stricture and compression which the intestines labour under at this time, is a sufficient cause for such cholics. Here we should never make

make a suture in such cases; but after having dilated the teguments, or even the PERITONÆUM, if the intestine could not otherwise be reduced, in order to keep that up, we must introduce a large thick linen sindon on the inside of the peritonæum, suspended with a double thread, and to keep it fixed there, with lint and other dressings. Mr. Pausch, Surgeon Major of the regiment de Knyphausen, whom we have formerly mentioned, practised this method with great success on two patients, who were wounded with grape shot, at the reduction of fort Washington, in North America. When a ball penetrates the lower belly, and wounds some of the VISCERA, this wound is very seldom cured, and that for many reasons.

The first is, that as there is often a swelling upon the external parts wounded by a gun shot, so there may also be on the internal parts. The second is, the impossibility of preventing or mitigating that symptom here,

here, by useful incisions, or the application of suitable topical medicines; hence the inflammation and gangrene generally carry off the patient in a few days. The third reason is, the impossibility we meet with in some cases, of hindering the discharge from being diffused into the cavity; and this discharge may either be the pus of the wound, the aliment if the stomach is penetrated, the excrements when the intestines are pierced, or the urine when the bladder is opened towards the ABDOMEN. Indeed, we may look upon the following as mortal; wounds of the stomach, of the small intestines, of the great intestines, and those of the PANCREAS and LIVER, when this last is wounded on its concave side, though there have been a few instances of the latter being cured. With regard to those of the large blood vessels they are always fatal.

In all these cases, it is in vain to hunt after the bullet, if it be lost in the cavity: The

The principal object of the surgeon's aim is to prevent the inflammation of the wounded parts; because that will be prejudicial to the efforts of nature, which, as we have formerly said, must alone bring about the cure of internal wounds. With this view we must have recourse to emollient and discutient fomentations often renewed; though the wound of the teguments be not the most dangerous point, it is convenient, however, to enlarge it; but we must not dilate that of the PERITONÆUM, because in so doing we would open a way for the intestines to fall out, and produce a rupture at the wound. This rule, however, is not without exception; such as, if the wound be upon the convex part of the liver, which is not in contact with the diaphragm, we must dilate the orifice of the PERITONÆUM, as well as of the common teguments; because here we need be under no apprehensions of a rupture, as in other places: But we must not go farther,

because the eschar formed by the bullet is of useful efficacy in preventing a hæmorrhage. If the incision enables us to feel the bullet, we must extract it, even though sunk into the substance of the liver.

What has been observed of wounds inflicted on the convex side of the liver, is likewise applicable to the wounds of such parts as lie not floating in the cavity, but are attached to one fixed place by the PERITONÆUM, or MESOCOLON, and which may be wounded, though the bullet pierces not into the common cavity of the ABDOMEN. The spleen is one of these parts, as well as the CŒCUM, and part of the COLON, the gross excrements of which may be discharged through the wound.

The same remark holds with regard to the wound of a kidney; supposing it to be on the back part or towards the loins. As all these parts are covered with thick fleshy muscles, the external wound should be dilated a good deal,

deal, even as deep as the PERITONÆUM inclusively.

Wounds that penetrate into the substance of a kidney, require a method of dressing peculiar to themselves.

As the urine is constantly discharging itself by the wound, it is proper to besmear that with greasy medicines, and thereby defend its surface against the urinous salt, which would otherwise occasion very troublesome smartings, and indurate the fleshy sides.

Remarks on penetrating wounds on the pelvis, and the ossa ilium or haunch bone, and of wounds on the parts of generation.

A Ball may run into the PELVIS, and be lost there; or it may pierce quite through from above downwards, either in a horizontal direction, or obliquely. The great quantity of blood vessels situated in this part, renders these wounds full of danger; and if one of a considerable size be opened, the patient will be carried off, on account of the impossibility of conveying assistance to the seat of that disorder. The eschar, indeed, or even the clotted blood may stay the hæmorrhage for some time: But the patient will be in a most dangerous condition, upon

upon the separation of that eschar or clod of blood.

And, besides, the bladder is surrounded with a remarkable cellular substance, that easily inflames; and if a spreading thin suppuration comes on, it will be impossible to introduce the means of cure that art points out, in such a case.

The bladder may be perforated; and if it was distended with urine at that time, there is probably no great laceration, and the wound is narrow; on this account we have seen many such wounds heal up. Cases have even occurred where the bullet, and other extraneous bodies, have remained in the cavity of the bladder, which comes pretty near to a proof that it was then full of urine. In this case after having treated the external wound in a proper manner, it will not be amiss to introduce a catheter by the URETHRA, that the urine may be constantly draining off; for a distension of the bladder will

will separate its sides, and of consequence the lips of the wound; then the urine may ouze out into the surrounding cellular substance, and thereby give rise to abcesses, and to other troublesome symptoms; whereas, that cellular substance being in a sound condition, will contribute more than any thing to the re-union of the bladder. There have been instances of patients, with whom the extraneous bodies remained in the bladder, who have passed them along the urethra with their urine, before they were crusted over with gravel: and others again, have had the stone, which has afterwards rendered it necessary to extract it by the common operation. And then these extraneous substances, such as a bullet, a rag of cloth, &c. have been found to form even the kernel of the stone.

The rectum, or straight gut, may be pierced; and if the wound be higher than the surgeon's fingers can reach, the treatment is the same as that of wounds in the bladder.

bladder. If the wound be towards the extremity of the rectum, it may be necessary sometimes to perform the operation requisite in a fistula; at least the requisite incisions should be made on the surrounding fat. There are two very essential points to be observed here, in the course of dressings; the first is, to preserve the diameter of the ANUS as much as possible, by introducing a suppository perforated in the form of a canula or pipe, as soon as the orifice seems threatened with constriction. The second is, to prevent a looseness, that might disturb the condition of the wound, from whatever cause it proceeded.

With regard to a gun-shot on the ossa ilium, or haunch bone, when it is fractured it is of the same nature as that of the scapula: as it is likewise covered with thick muscles, our incisions should not be inflicted too sparingly; and they should be made as deep as the fracture, to facilitate the extraction

tion of splinters, or of any pieces of bone, that are loose and displaced. If the bullet after having made its way through the bone, has not pierced very far into the PELVIS, but is stopt in the cellular membrane of the PERITONÆUM, or at the inner surface of the bone, betwixt that and the muscles which cover it internally; in short, if it lies not deep, which we can sometimes discover by introducing the sound or finger, in order to accomplish its extraction, we must enlarge the orifice of the bone with the exfoliating trepan, or cutting forceps. In the course of dressing, fungous flesh is apt to rise upon this wound, as in all other spungy bones, when fractured by a gun-shot; the surgeon should therefore obviate these funguses by the application of drying medicines, but if they are already risen, he must take them off, and destroy their roots in the manner formerly recommended.

Fractures of this bone heal, in general, without any sensible exfoliation, if care has been taken to extract all the loose portions of the bone, and the splinters; but if any of these remain displaced, they will render the wound fistulous. If the ball should be lost in the ABDOMEN or PELVIS, this circumstance does not change the mode of treatment, and the surgeon ought to pursue the same rules that have been laid down relating to the fracture of the bone.

With regard to a contused wound from gun shot, on the parts of generation, it is generally followed with a considerable ecchymosis and swelling, that reaches over the scrotum: And this ecchymosis and swelling is communicated in the same manner to the PENIS, and sometimes reaches as high as the belly, along the spermatick chord; and then inflammation speedily succeeds. In this case a gangrene is to be feared; and, by way of prevention, we must multiply the

incisions in proportionas this accident seems advancing, and the peruvian bark ought to be given copiously.

After the necessary incisions are made, we must deal lavishly in spirituous and discutient fomentations, often repeated. Should the penis be so much swelled as to block up the urinary passage, a catheter must be introduced thereby into the bladder. If the end of the PENIS has been shot off, we must put a CANULA into the beginning of the urinary canal, of a convenient length and thickness, to prevent not only the orifice from being contracted in its diameter, but also to hinder it shrinking up, and concealing itself amidst the fleshy parts, as I have seen happen in three instances during the campaigns in America.

Observations

Observations on gun-shot wounds in the joints.

GUN-shot wounds inflicted upon, or near the joints, where the capsular ligament is not lacerated, deviate in no point from the general mode of treatment recommended in the preceding pages; and they are very often cured by the means that have been proposed.

Such wounds as are of great extent, even when the joint is partly destroyed, by a little portion of it being shot off, (as will be stated hereafter, in the case of the gallant Major Ferguson) these, it is to be observed, are less subject to bad accidents, than such as penetrate into the joint, or even than a considerable bruise occasioned there; the reason of which, it is presumed, is as follows.

In a violent contusion, as when a bullet pierces through and through, the commotion or shock, is communicated to the whole articulation; the EPIPHYSIS may be separated; the capsula, ligaments, tendons, synovial fat and glands are injured. But large wounds have this advantage, that their suppuration, when it can be established, is a salutary fountain, from which we may expect an evacuation or drain from all the damaged parts; whereas, in narrow deep wounds and in a violent contusion, the suppuration is scarcely ever kept up but at the expence of the whole articulation, and even of the whole limb. For the synovial glands become replete, the fat inflames and suppurates, the epiphysis are soaked and swell, the bone turns carious, the CAPSULA and APONEUROSIS rot, and inflammatory thin fusions of matter creep along the muscles that transmit their tendons over the joint, and thereby occasion abcesses throughout the whole length of the limb.

We

We have in the former part of this work made a great difference betwixt wounds of fleshy, and those of tendinous parts; and I have explained the reason of these last being much more liable to bad symptoms than the former. We shall therefore avoid repetition, and only observe with regard to wounds of the joints, that their danger arises not from the nature of the surrounding tendinous parts alone, but also from the structure of the joint, which being of a considerable thickness, will not allow advantageous incisions to be made. Upon this principle I will add that a wound, wherein half of the joint has been shot off, must be considered as much less dangerous than small penetrating ones, that is, such as pass quite through from side to side; it is to be observed, however, that all of them are subject to dangerous accidents when the capsular ligament is opened; and that very few of them are cured, except by amputating the limb; and that the most secure method

of

of obviating the bad symptoms that may follow, and perhaps endanger the life of the patient, is, by a speedy amputation above the wounded joint; and, if it can be done in the field of action, it will be so much the better.

However, should circumstances induce the surgeon to attempt the cure of the wound without amputation, he should make liberal incisions, and borrow all the assistance he can frrom such general or particular remedies as we have already recommended; he should, as has already been observed, avoid in his dressings all applications that are greasy or promoters of pus, and substitute in their place drying vulnerary, and spirituous medicines alone.

If he should be happy enough to prevent, or to stop the progress of all the bad symptoms, that such wounds are liable to, yet still he may, with some reason, be apprehensive, that the greatest number of these patients

tients will be carried off, towards the latter part of the treatment, by a MARASMUS, or DIARRHÆA, the common consequences of long suppurations: On which account he ought to guard against these, by a suitable regimen, by cordials, the peruvian bark, and other remedies appropriated to the different circumstances.

When these wounds do not carry the patient off, they may probably remain fistulous; and the joint almost always continues void of motion, that is, forms an ANCHYLOSIS. With regard to the FISTULA, which is the consequence of a caries in the bone, or of some remaining splinters that ought to come out, this must be the work of nature; and the surgeon can seldom assist her much. In regard to the anchylosis, as it is not occasioned by the petrifaction of the SYNOVIA, but by a kind of stiff dryness in the parts, in consequence of the cicatrix, and the destruction of the synovial glands, so, we can only

only expect a return of the joint's motion, by the use of emollient embrocations, and by warm bathing; during which course we should move the articulation gently, and gradually force the stiffened parts to obey the motion.

Wound of the gallant Major Ferguson.

Major Ferguson, who commanded a corps of rifle-men during the American war, and an officer of distinguished talents, at the battle of Brandywine, was struck by a musquet ball on the elbow joint of his right arm. The ball, in its passage, carried off the obtuse point of the articulation, commonly called the olecranon. I dressed his wound shortly after, on the field of action, and was happy to find no splinters on the ulna, but barely its knob taken away as clean as if it had been done by a saw. He was soon after bled, and the whole articulation covered with a large poultice, composed of bread and milk, with a sufficient portion of oil to keep it moist. About ten o'clock at night he was attacked with

with violent spasms, when a clyster was immediately thrown up, and a draught with some laudanum taken soon after. This seemed to compose him for about two hours, but when he awoke the spasms returned. As his whole nervous system was shook with irritation, we resolved to repeat the anodyne, and gave him sixty drops more, which, in all, made one hundred drops of laudanum. Soon after he went to sleep, and was composed till nine the next morning. During this day he continued free from spasm, but when night came on they returned again, but with much less violence. The clyster was again repeated, and afterwards his anodyne. This night was much more composed than the former, free from any return of the spasms, which afterwards entirely left him.

On removing the dressings, the wound discharged a bloody ischor, and continued to do so, more or less, for the space of six weeks, although the bark and other internal medi-

cines had been applied copiously. On the forty third day the discharge became laudable. In the space of another month an exfoliation of the bone took place, and soon after the wound was healed over, when this valuable officer was again restored to the army, his general health being established, but unfortunately a considerable degree of stiffness in the joint continued ever after.

Of wounds in the arm.

GUN-shot wounds in the arm, whether they are simple or complicated with a fracture of the HUMERUS, deviate not from the general rule hitherto recommended; wherefore I shall content myself with making a few reflections upon the structure of the part.

Both

Both in the time, and intervals of dressing, when the bone is fractured, care must be taken to keep the broken pieces as much fixed and supported in their natural place, as if no fracture had happened.

With this view, having dressed the wound in the manner we have recommended, the whole circumference of the part must be inclosed with two flexible splints. I have often been obliged to use paste-board, and sometimes the bark of trees for this purpose in America, shaped to the form of that part, and tied on with tapes. These splints being closely applied along the member, keep it fast, when at the same time they make no compression; they are not weighty, and theygive great ease to the patient, who would otherwise feel pain in every motion of his body. In order to prevent the least motion of the wounded parts, we make a window or void space in the splints, and thereby dress the wound, without being obliged to remove them. These splints are much more useful and

commodious than the bands recommended by the old practitioners.

If the entrance or exit of the bullet be near the brachial artery, it may so happen, that the bullet has bruised or lacerated that vessel, or some of its larger branches detached to the muscles, even though the blood does not stream ; because the contusion may br violent enough to stop the hæmorrhage. The surgeon ought then to be upon his guard against this hæmorrhage, that may, and indeed naturally should happen, when the eschar falls.

On which account, by way of prevention, he ought to dress that part of the wound with dry digestives only, which will give the opened vessel time to be closed up. But as the hæmorrhage may burst forth suddenly every moment, whatever precaution we take, it is requisite to leave a tourniquet on the upper part of the arm applied only loose, and ready to be made tight as soon as the bleeding

bleeding appears; which any person present may do as well as the surgeon himself. As this ligature made by the tourniquet serves only to procure command of the blood for a short time, when the surgeon is called he should lay the vessel bare, either by a proper incision, or (if it can be done) without any cutting means, and tie the artery as we have directed. If the wound be in the trunk of the artery, he must nevertheless tie it, and hold himself in readiness to amputate the arm, if it should be threatened with a gangrene, through want of nourishment. During the treatment of wounds of the arm, care should be taken to keep the fore arm half bended, on a double account: The first is, because in this posture the flexor and extensor muscles are both relaxed. The second is, that when the cure is completed, the motion of flexion and extension in the fore arm, will be difficult and confined for a long time, on account of the scars that bridle and constrain the action of the

the flexor or extensor muscles, according to the situation of the wound. When the fore arm continues bended, the patient may have the use of his hand, which he could not, had the fore arm remained extended.

Wound of Capt. van Nagel.

Mr. Stieglitz, Surgeon Major of the regiment de Donop, of the Hessian army, a gentleman of distinguished abilities, desired my assistance for Captain Van Nagel, a gallant officer of the Hessian grenadiers, who was wounded in the arm by a grape shot, at the storming of Red bank fort, on the north side of the Delaware river, near Philadelphia, on the 23d of October, 1777, The ball entered the biceps muscle, about five inches above the elbow, and running obliquely upwards, made its exit out at the triceps muscle.

In its passage it fractured the bone, and the muscles both where the shot entered and passed out, were all jagged and torn,

torn. I immediately dilated both the orifices very largely, and being a robust man and in high health, recommended Mr. Stieglitz to bleed him copiously. This brave officer suffered much from this wound, which he bore with the greatest fortitude. For the space of seven weeks he lay on the broad of his back, on account of the shattered condition of the bone. His cure was completed in the space of thirteen weeks, during which time he took four pounds and a half of the peruvian bark: and the exfoliations that took place from the bone, weighed one ounce and two drachms.

Wound of the gallant Colonel Simco of the Queen's Rangers.

The next case I shall beg leave to state, of a gun-shot wound in the arm, was that received by the gallant Colonel Simco, (now a General.) This indefatigable and enterprizing officer, who was so much distinguished in the American war for his zeal and abilities: In the campaign of 1778, having the advanced post of the British army, at the heights of Kingsbridge, in the province of New York, the

the Americans had employed in their service a body of Indians of the Stockbridge tribe, whom they repeatedly sent during the night time, to harrass the out-posts of our army, and to commit depredations upon all those inhabitants that were friendly to the British government, about the lines.

They continued these depredations for several nights, returning always by the dawn of the next day to the American army, and eluded for some time this vigilant officer.

However, on the night of the 24th of September, one of the scouts came in, with intelligence of their advancing. The Colonel had his regiment immediately under arms. The corps to which I then was attached being encamped at a small distance, I applied to the Colonel for leave to accompany him on the enterprize, which he readily granted. The batallion marched about one o'clock in the morning, and to prevent being discovered, posted themselves in a wood about three

miles

miles from our encampment: As soon as day began to break, several Videts climbed up high trees with a view to discover the savages.

This manœuvre had the desired effect, and they were soon discovered, concealed in a large field of Indian corn, about a quarter of a mile distance.

They were soon after surrounded by the Queen's Rangers, and when they found themselves discovered, they started up and threw in their fire, after which they were immediately charged with the bayonet, and their whole force cut to pieces, together with their chief called Nimham. They were all armed with scalping knives and tommyhawks in the Indian style.

In this action Colonel Simco was wounded by a musquet ball in the right arm. The bullet passed through and through, piercing deep under the biceps muscle, very near the artery, which fortunately escaped from contusion.

I dressed him soon after in the field of action: As the wound bled profusely, a tourniquet was fixed by way of security, and he marched home with the regiment in good spirits.

I recommended him on his return to the encampment to go to rest as soon as possible. The inflammation and pain increasing, towards night he had an opiate, but had little or no rest till morning. As the inflammation was advancing very fast I opened a vein, and took away some blood, keeping the wound covered with a bed of emollient poultice. The following night was much more composed, and in the morning he was much better, and freer from pain. When the dressings were removed the wound had a favourable appearance of suppurating kindly, and in a few days more there was a laudable discharge of good matter. By the use of the peruvian bark alone, and simple dressings to the

the wound, this brave officer was restored to his pristine health in the space of five weeks. During which time he lived in his tent in the encampment, and prefered keeping the field to going into quarters, notwithstanding the repeated solicitations of his Excellency Sir Henry Clinton, then commander in chief; a name that will be ever held in veneration, whose greatest pride was the welfare and happiness of the brave warriors under his command.

Gun-shot wounds of the fore-arm are more susceptible of bad symptoms than those of the arm.

Of wounds in the fore arm.

The difference arises from this, that all the muscles situated upon the fore-arm, are conjointly wrapt up in a tendinous membrane, that is, an APONEUROSIS or expansion, detached from all the flexor and extensor muscles; which membrane dipping into the interstices of all the muscles of the part, covers each of them likewise in particular. The

inflammation of this membrane is therefore greatly to be feared, since in that state, it strangles at once all these ; and besides it may spread and communicate itself to the arm likewise.

When this ensues, we observe the whole fore arm swell up in a greater or less degree, and sometimes becomes so hard, that a gangrene must speedily succeed if not prevented. Hence the great advantages arising from an early dilatation, so often mentioned in this work.

On this account the incisions that are made should penetrate to the bottom, and unbridle all the parts, but chiefly the common tendinous membrane, in every direction, especially when the radius or ulna is fractured. These incisions should be backed with all kinds of topical emollients, fit for relaxing the skin, and common membrane, which is now extremely tense.

Should

Should all these endeavours fail, and the swelling continues, accompanied with hardness, and increases so as to threaten a sudden gangrene over the whole part, recourse must be had without delay to the scarifications, of which we have formerly spoken. When the swelling that ensued has not been violent enough to require these scarifications, yet its existence may be sufficient to expose the fore arm to some accident or another: And we sometimes meet with abcesses formed in different places; abcesses distinct one from another. and that have no communication with the cavity of the wound, because of the various partitions made by the common membrane in the interstices of the muscles. While the pus is forming here, the wound assumes a bad hue, which continues until the matter is evacuated. These abcesses must be opened as soon as the pus can be perceived to fluctuate under the

the fingers. The inflammation and swelling sometimes cannot be appeased, till it terminates in the dissolution and rotting of the common membrane, which occasions thin spreading suppurations, both under the skin, and among the interstices of the muscles. The fore arm is then in a clammy œdematous state; and soon after, the thin suppurations make way for discharging themselves by the wound: But we must, notwithstanding this, lay these sinuses open their whole length, or in part, that we may be enabled to introduce proper topical applications upon all those membranes that must be thrown off, and thereby assist nature in their separation, and likewise that we may be able to cleanse the wound. As the two bones of the fore arm are covered with muscles, which adhere so much more firmly, because they have their fixed attachments in this place, it is possible that in the great confusion and disorder, the surgeon has not been called in time, to extract

tract all the splinters. When the swelling is abated, either without suppuration, or by such dissolution of the membranes as we have just now mentioned, the surgeon must endeavour to take out the splinters, for the wound becomes then fresh and sensible; and their points or edges might occasion such exquisite pain as would bring on convulsive motions. If the first incisions have been made large enough, and if the abcesses or sinuses just now mentioned, have been sufficiently opened, the extraction of these extraneous bodies will be greatly facilitated. We shall say no more about the method of dressing these wounds, having amply discussed that point in the former part of these observations.

Wounds, received by Mr Wm. Clarke, 16 Reg. Lt. Dgs

On the night of the 9th of February, 1777, Mr. W. Clarke of the 16th regiment of light dragoons, was ordered to patrole for about two miles beyond the British lines, at Brunswick

wick in the Jersies, North America : On his return about half way back, a number of the American militia rushed out of a wood on the side of the road, and attempted to seize the bridle of his horse and take him prisoner; he immediately fired upon them with his pistols, and put spurs to his horse, but in an instant they fired a whole volley of musquetry at him ; one ball entered his right buttock, another into the pectoral muscle of the same side, and a third entered at the lower end of the ulna at its articulation, with the wrist of the right arm. His horse was also wounded in two places. However, this brave fellow made good his retreat into the British lines. It was about one o'clock in the morning when I was called up to see him, and found every bullet was lodged. That lodged in the pectoral muscle was soon extracted, but the others was found impossible. The one which entered at the articulation

culation of the wrist, from the smallness of the orifice it seemed to be a slug or buck shot, and had got completely wedged in among the bones. The wounds were soon dilated, a soft dressing applied, and afterwards covered with an emollient cataplasm. Next day he had a considerable degree of fever, we took away some blood from his arm and opened his bowels. The following day on removing the dressings, the inflammation and swelling of his fore arm, hand, and fingers was very considerable, and in three days more, it increased so much as almost drowned the whole member. His other two wounds looked well, and had a favorable suppuration. On the fourteenth day an abcess began to form on the opposite side a little higher up, under the supinator muscle, and was soon after opened.

The aponeurosis of these muscles began to rot and shortly after sloughed away with

the dressings. Thus we continued our endeavours using every means that our art prescribes, with a view to save the limb of this brave man, but they all failed. On the fortieth day his other wounds were healed over, although the ball was still lodged in that of the buttock among the glutei muscles. All hopes of saving his arm being now over, on the morning of the forty third day after the accident, I performed the amputation, and his habit of body being very good the stump was healed over in the space of eighteen days. After the operation I dissected the arm, and found the extraneous body which had occasioned all the mischief, wedged in at the sinus, at the lower end of the radius; it proved to be a slug, which the Americans, as I have formerly observed, used frequently to put into their ball cartridges. In the space of six months, the bullet which waslodged in his buttock, had worked

itself down to his thigh towards the surface, and was taken out by a simple incision. It proved to be a musquet ball.

This gallant veteran is still alive and in high health, enjoys his out pension, and resides in James-Street, Kensington, having seen him a few days ago.

Gun-shot wounds of the wrist are generally accompanied with a fracture; I mean, that some one, or even a number of its small bones are curtailed, ground down, or shot away; and this can never happen but when the connecting ligaments and APONEUROSIS of these bones must be greatly injured, and the tendons that pass over this part broke or much lacerated. With regard to the wound of the tendons, this injury may occasion such accidents as we shall treat of when we come to our remarks on wounds of the METACARPUS or hand.

Of gun-shot wounds in the wrist.

The inflammation may be kept from spreading over the ligaments and CAPSULA

of the joint, betwixt the wrist and fore arm, the dissolution and rotting of the injured tendinous parts may be prevented, by the incisions and counter openings, the regimen, the bleedings, and topical applications, and the peruvian bark, which we have before recommended.

When these things are judiciously observed, we have often seen the wounds of this part heal up with great ease.

Wounds of the METACARPUS or hand, may be liable to a great many bad symptoms as well on account of the number of bones which may happen to be fractured, as on account of all the tendons that pass over this part, for moving the fingers. When these tendons are lacerated or bruised, they inflame; and their inflammation is communicated to the muscles on the fore arm, and there occasions a greater or less swelling, and even frequently produces abcesses in their interstices. This seldom happens, but at the

Of wounds in the metacarpus or hand.

the same time the annular ligament, that binds down these tendons at the wrist, participates more or less in the swelling. These accidents must be prevented, if possible, by the means which we have pointed out, in the sixth, seventh, and eighth chapters, and thither I refer the reader, likewise for the proper dressings of such wounds. I shall only add, with regard to abcesses generated in the fore arm, that if they are not opened betimes, the pus or matter will run out by the wound in the hand, along the tendons which march thither; and that this discharge of the pus will render the abcess more tedious of opening, than when the tumor makes a close cavity and thereby confines the pus. Though there be a communication betwixt the abcess, which has been opened, and the wound, we may ordinarily dispense with joining the two orifices into one; and we must, as much as ever we can, preserve the annular ligament without dividing it. We have, sometimes, however

however, met with cases, where it was absolutely necessary to even cut this ligament, because it strangled the part too much by its swelling.

Of wounds of the fingers.

A gun-shot wound seldom happens to one of the fingers, except when part of that finger is shot quite away. These wounds are frequently attended with inflammation and abcesses that spread over the hand, and sometimes over the fore arm; such accidents must be prevented by the assistance which we have recommended elsewhere. The fingers are so useful and necessary to man, that we must neglect no means of preserving them if possible; and suppose the wound of a finger is complicated with a fracture, we must observe the same conduct as if it had been the arm or thigh, the bone of which is never broke smooth.

It is necessary, in some cases, to perform the amputation, either at the next superior PHALANX, or at the middle of the PHALANX

LANX itself, above the wound. I shall excuse myself from describing the manner of doing this, and refer to the different treatises on the operations. Though the wounds which may happen to the first PHALANX of the thumb, differ from those of the fingers, because of the thick muscles which cover this part, yet we shall pass them over in silence, being of the same nature with all wounds of parts where the bone is surrounded by large muscles, and require the same treatment from the surgeon.

Of wounds of the thigh.

The more fleshy any limb be, the more danger there is of swelling, after a gun-shot wound has pierced deep. The thigh is of this kind, being covered with very large muscles and much fat, especially at its superior part: On which account we must inflict more liberal incisions here than in another place, especially if the bone is broken or laid bare. I know that large wounds are followed by large suppurations, and that large suppurations exhaust

haust the patients ; but I know also, by experience, that when ample incisions are made, the parts will be much less disturbed in extracting the extraneous bodies, which will spare a great deal of pain, and hasten the cure. The painful frictions and lacerations occasioned in the nervous system, by searching through narrow and slanting passages for the extraneous bodies, will irritate far more than the incisions which I recommend, indeed more than the bullet could do by piercing the soft parts, nay even perhaps more than it could do by fracturing the bone. By these incisions we prevent congestions and suppurations, that would in the end oblige us to make incisions of a much greater extent.

The tendinous expansion of the APONEUROSIS of the FASCIA LATA, which invests a great part of the muscles that compose the thigh, requires particular care in unbridling

and

and dividing it in all directions, as is necessary when the wound affects this membrane: And if this method be neglected it may inflame, rot, and be dissolved. The crural artery, as every surgeon knows, sends off a a great many branches of a considerable size, to the muscles of the thigh; and it is possible, we may open some of these in making the incisions. In this case the hæmorrhage must be stopt by the ligature.

Besides, it may so happen, that some of these branches bleed upon the separation of the eschar; wherefore, if from the situation of the wound, we are under apprehensions of this accident, we must keep a tourniquet loosely applied above the wounded part, as we directed in our observations on wounds in the arm.

Supposing the trunk of the crural artery be opened, the patient must quickly expire, if the surgeon be not then at hand, or at least in a very short time present, to stop the

hæmorrhage with a tourniquet; after which he ought immediately to make a ligature upon the artery, immediately above its orifice, even if it was divided where it passes over the PUBIS.

It is true indeed, after such a ligature the thigh must mortify, if there should be no branch large enough detached to the muscles or neighbouring parts, that can supply the want of the trunk, which will be known in a few days: But in the first attack our business is only to save the patient from dying in his blood; and after that, we can next perform the amputation. Without saying any thing more of the dressings, which have been already explained in the preceding chapters, I shall only observe, that, supposing the FEMUR is broke in pieces, and there is reason to hope the thigh may be preserved, we must, after all the intentions of art are fulfilled, manage the affair in such manner, that the other remaining pieces of bone be kept fixed in their natural place, and hindered from playing one against the other,

as

as we have before observed in our remarks on wounds in the arm.

At the battle of Prince Town in the Jersies, North America, on the 3d of January, 1777, memorable for the distinguished valour displayed by the 17th regiment of infantry, and two hundred of the 16th regiment of light dragoons, under the command of Colonel Mahood, who on their march to join Lord Cornwallis at Brunswick, about fourteen miles distance, were unexpectedly attacked by the whole army of General Washington, and notwithstanding the superior number of the Americans, amounting by report to upwards of ten thousand men, this gallant detachment cut their way through them and made good their retreat to Brunswick. This was reckoned one of the most gallant exploits during the whole war.

In this action Serjeant John Miller of the 16th regiment of light dragoons was wounded in his right thigh, by a grape shot fired from a cannon: The ball entered the vestus

internus muscle a little above the center of the limb, and running obliquely upwards, made its exit through the externus muscle of that name on the opposite side. The bullet pierced very deep and fractured the bone, and unfortunately for him it shattered a pen-knife that was in his pocket, some of the splinters of which were carried into the wound, and dispersed among the interstices of the muscles. There was a prodigious laceration made in the thigh by this blow, and the muscles, both where the bullet entered and passed out were jagged and torn, to a much greater degree than any other wound that occured during the war from a similar shot.

As soon as possible, I made a very large dilatation of both the orifices, and for the present applied a soft dressing, and secured the broken bone, as well as the great emergency of the time would admit, till we arrived at head quarters, when he was bled largely. Soon after a clyster was thrown up, and about

about bed time he had a draught with a few drops of laudanum, which was ordered to be repeated in case of spasms during the night.

In the morning his fever ran very high, and the inflammation and swelling of the limb I perceived to increase with great rapidity. I bled him again copiously, after which, a few grains of nitre, with testaceous powder was taken every two hours during this and the succeeding day.

In the morning, on removing the dressings there was a considerable discharge of thin bloody ichor came away, and with it a piece of his leather breeches, which the ball had carried into the wound, which was now dressed with warm balsamic digestives, and over all an emollient poultice. On the fifth day, a suppuration took place, and he began to take the bark, which was increased by degrees to as much as his stomach would bear. This method was continued for fourteen days, and, all circumstances considered, things went on

on as well as could be expected, when an abcess began to form on the thigh, about five inches below, but before it could be opened, it began to discharge itself by a sinus into the internal orifice of the wound. The sinus was soon laid open its whole length, and in two days after, a piece of the handle of his pen-knife, which the bullet had broke, came away with the dressings, just underneath where the abcess had formed, and three more portions of the same extraneous body in the space of a few days afterwards was extracted, a considerable distance from where the ball entered. A great change after this took place, for the better, and by persevering in the use of the bark, this brave soldier mended daily. There was a large exfoliation of the bone followed this wound, which soon after healed over, and his cure was perfectly completed,—during which he took four pounds and ten ounces of the bark.

The

Of wounds in the Legs.

The muscles of the leg being completely invested with a common tendinous membrane, and fixed along their whole length to the bones, is therefore in the same circumstances as the fore arm, when wounded by a shot: And, on which account we shall say but little concerning it, because I should repeat the rules, that has formerly been laid down with regard to such sort of wounds. If the TENDO ACHILLES should happen to be compleatly divided by a ball, besides the incisions and other treatment that may be necessary, the patient's foot must be kept extended by a proper bandage. By this means the divided lips are brought into contact, which the bending of the foot would constantly be separating; and when the patient recovers, nature will have less trouble in filling up the empty space, and cicatrizing the wound. It is very possible that the cicatrix which is formed here may be somewhat of a tendinous nature, being partly generated from the juices which ouzes out from the extremities of the

TENDON

TENDON OF ACHILLES, and consequently be firm enough to supply the defect of that tendon.

If this tendon has only been half cut through, the situation of the foot when kept in a constant state of extension, will give ease to that portion which is not divided; fewer bad symptoms will cast up, the cicatrix will be sooner formed, and when the patient is cured, he may have the free motions of his foot preserved.

Of wounds in the TARSUS.

Gun-shot wounds of the TARSUS when the bullet remains in its substance, or when it has pierced quite through are much more dangerous than those of the wrist: And many reasons may be given for this. First, the bones of the TARSUS are larger than those of the wrist, and of consequence a greater havock is occasioned here. Secondly, the tendinous parts that cover these bones and tie them together, are larger and more numerous. Thus the nervous system suffers more in the injury. Thirdly, the conjoined group

of

of bones in the TARSUS form a much thicker body, and therefore we cannot reach them with our incisions to the bottom of the wound, as in the soft fleshy parts. These wounds should therefore be regarded as being of very great consequence, and even it may be said, of as great importance, as those that pierce a joint quite through.

If the leg is not amputated, whatever we can do by way of prevention, they are ordinarily accompanied with racking pain, with swelling and inflammation, the companions of the former, and with rotting suppurations, the consequence of these last, and with convulsive motions of the limb. It cannot be denied, that in some instances these wounds have been cured without the amputation; but so many patients have been lost through a neglect of this practice, that there seems a necessary inducement of amputating expeditiously. Those who have supposed that there was no immediate necessity of having recourse to this, have probably been

deceived by the swelling that appeared moderate for the first few days: But if we reflect on the structure of this part, we will soon discover that it is not fleshy enough to allow of a great increase of bulk under inflammation: On which account the surgeon must collate the slight swelling that appears, with the tendinous and boney structure of the part, and with the accidents that may naturally be expected, or already show themselves, in order to judge of the probable consequence. If the swelling of the TARSUS is moderate the leg swells, and this should determine the practitioner to a salutary decision.

We may say in general, that these kinds of wounds require the amputation of the member to be undertaken expeditiously, if we would have it succeed. But as some of the wounded have been cured without the operation, the surgeon must be directed in his conduct, by the state of the patient, and condition of the wounded part.

If

If the foreign body which wounded the TARSUS, has not pierced through the knot of bones which compose this part from side to side, but without penetrating deep into its substance, has shot away some portion of it, and thereby made a large open wound, that is not covered with the skin; this wound may be cured with proper treatment, without amputation, provided the joint between the foot and leg has not been damaged, nor its capsular ligament laid open.

Of wounds in the Metatarsus.

Wounds of the METATARSUS or foot, are not analogous to those of the METACARPUS, because the sole of the foot is much thicker than the palm of the hand. What causes this thickness, is, that the bones of the METATARSUS are covered on this side with very thick muscles; these muscles again with a tendinous expansion, somewhat in form resembling a goose foot; this expansion with a good deal of fat; and that fat with a very thick skin, which is still invested with a thick horny scarf skin.

Bad symptoms are therefore so much the more to be apprehended, as the goose foot expansion may swell and inflame, and then it will too much confine and strangle the muscles and fat, especially if these are likewise enlarged by inflammation. Add to this, that the skin and scarf skin, which are very hard, do not easily give way to the swelling of these enclosed parts, whence a mortification may quickly ensue, if not industriously prevented.

Hence the wounds of the METATARSUS have this peculiarity, that the incisions we have recommended so often, should be made here with loss of substance. I mean, that we must remove a portion of the skin, and even of the goose foot expansion; otherwise the incisions will be almost fruitless, for the inflamed fatty substance, and even the bodies of the muscles, would puff up so luxuriant, as to produce a kind of HERNIA at the wound in form of a mushroom.

With

With regard to gun-shot wounds of the toes, they are analogous in their nature and cure to those of the fingers, on which account to avoid unnecessary repetition, I shall pass them over.

Wound of Mr. Serjeant Talkerton.

During the attack made by a small detachment of the 16th regiment of light dragoons, upon a party of the Americans who were stationed in a large stone house, on the 30th of October, 1777, in the province of Pensylvania, as formerly mentioned, p. 187, Mr. Serj. Talkerton of the above gallant corps, who distinguished himself with great valour upon that enterprize, was struck on the center of his right foot, by a musquet ball fired from a window in the second story, it passed through and through, boot and all, between the metatarsal bones of the toes next to the great toe. There was a great laceration of the tendons from this wound. I took the early precaution to make a large dilatation of both the orifices, especially on the

the sole of the foot where the bullet had made its exit, and also removed a large portion of the horny scarf skin. A number of bad symptoms followed this wound, and I am well convinced many more would have happened, had I not put the above means early into practice.

By the use of topical emollients, and the bark, with the usual attention paid to the wound, he was perfectly cured in the space of sixty four days.

CHAPTER

CHAPTER XI.

An enquiry into the nature and causes of suppuration in gun-shot wounds.

THE design of the following observations is to examine, with some accuracy, and consider what most frequently happens in the human body, when some vessels, especially those which contain blood, have suffered a solution of continuity, and what are the means which nature (always employed in her own preservation) makes use of on such occasions,

in

in order to deliver herself from every thing which may be prejudicial to her, and to restore the divided parts to their natural union.

This enquiry is highly necessary, and the subject itself seems to call for the greatest care and attention of all practitioners; because, for the most part, it is hardly possible that the substance of the part torn, cut, or contused in many species of wounds, should be repaired, or regenerated, without this preliminary work of nature. Indeed, many tumors may be observed, which provident nature terminates by a suppuration; with a design, no doubt, that by the formation of pus, the part being freed from that which, for some time had interrupted its functions, may restore itself to its natural state; and that the particles which formed its texture, and had been separated from each other, may be again brought into contact, and be united.

united. It may also be remarked in various species of wounds, especially gun-shot, that the re-union is almost never made till they have suppurated. But there are great varieties in suppuration; since this work of nature presents us with as many differences as are observable, not only in the structure of the solid parts, and the quality of the fluids; but also in the manner in which the solid parts have been lacerated, and in the method used in treating them. Art then must vary the succours, of which nature, sometimes incapable of assisting herself, stands in need, in order to begin and finish a suppuration. We shall therefore here briefly treat of this subject, and make the mechanism of suppuration in the soft parts our principal business; which will contribute to illustrate not only the theory, but also the treatment and cure of gun-shot wounds and also those of tumors and ulcers.

Every person is acquainted with the sensible qualities of that fluid, which is never found

in the human body in its natural state, and which we call pus; which is generally viscid and whitish, of a middling consistence, and formed in the solid parts by the stagnation of extravasated blood: But the manner in which this pus is produced, which we call SUPPURATION, is not so clear and evident, but that it may deserve a careful and accurate examination. We shall not confine our researches to this enquiry alone, but in order to render the history of suppuration more complete, shall consider the symptoms which accompany it when it is commenced. Then it shall be our endeavour to explain what things are capable, either of hindering its formation, stopping its course, or producing any material changes in it. And lastly we shall specify those things which are proper, either to excite it, or to favour its progress.

A suppuration never happens, but in such parts as are alive. This is sufficiently clear, since every suppurating part has both heat and sensation, and those even in a greater degree than

than in their natural state; for on this occasion, it is extremely painful and burning: besides we have no observation, either of a medicinal, or chirurgical nature, to prove, that a part entirely mortified, as in a sphacelous, has ever come to a suppuration. It is also to be observed, that a suppuration never happens in the substance of any part, unless small blood vessels are broken in that part. This observation implies two things; the first of which is, that pus is not formed in the cavity of the blood vessels, so long as they are sound and entire; and the second, that it is not sufficient for the formation of pus, that any sorts of vessels be indifferently broken, but it is absolutely necessary for this purpose, that SMALL blood vessels should be ruptured. The first part of this observation is demonstrated by what is daily noticed in practice, namely, that the suppuration of a part is always preceded by a dilaceration of the substance of that part, produced ei-

ther by internal or external causes ; and that no observation has hitherto evinced the formation of pus in a blood vessel, when that vessel is sound and entire.

The second part of the above observation appears sufficiently proved by the following reasons : it is certain that in the compositions of the parts, there are vessels of different natures, so that some of these may break rather than others. Now it has been observed, that a suppuration was never brought on in a wound whose blood vessels remained intire, though the vessels of any other species were divided. For when the lymphatic, pinguiferous, or neurolymphatic vessels, which are distributed through the whole body are broken, such a rupture is succeeded by an accumulation of serum, and sometimes by hard tumors without pain, which remain long in this state of insensibility and hardness ; and most frequently by undigested tumors, full of a thick matter which resembles

suet,

suet, and is always the same without any action, for which reason they are called COLD TUMORS; but pus was never observed to be formed in these kind of tumors. Moreover, all parts abounding with blood, often and easily come to a suppuration; whereas the parts which contain little or no blood, suppurate rarely, and with difficulty. And it is for this reason, that suppuration is one of the necessary consequences of inflammatory tumors. Hence it also happens that SCHIRROUS and ŒDEMATOUS tumors never terminate by suppuration, nor discover the least appearance of pus, unless the blood, by stopping in the parts which are either contiguous to those tumors, or in some measure forms them, has brought on a previous inflammation.

It is sometimes seen, that though there are blood vessels ruptured, yet a small quantity of blood being discharged into the substance of the part, no suppuration is by that means excited

excited, And what happens from contusion without a wound, bringing on an ecchymosis, is a sufficient demonstration of the cause of this; for on these occasions the blood is discharged into the texture of the part, but this blood is not collected and fluctuating into one place; since it is dispersed through the whole extent of the part, and makes it appear of a deep red or blackish colour. This colour becomes gradually paler and paler, by assuming different shades, till the part has regained its natural colour; which effect is produced by the insensible resolution of the extravasated blood, which gradually enters the current of the circulation without exciting any suppuration.

From the two preceding observations, it appears to follow, that the extravasated blood cannot convert itself into pus, though it should be inspisated and disposed to putrifaction by the vapours emitted from the adjacent parts,

to

to which it is exposed ; for it is sufficiently obvious, that the production of a suppuration requires other causes and conditions.

Our next observation shall be, an attempt to explain the mechanism by which the pus is formed in a live soft part, of which the languiferous and other vessels, composing its texture, have been broken. Among so many languiferous, and other vessels which form the soft parts of the human body, whether internal,as the viscera,or external,as the muscles and teguments; nothing is more common than to see some of these vessels break, in such a manner, that their intimate texture is by this means lacerated, without being entirely destroyed and corrupted. The causes of such a rupture or breaking of the vessels, are either internal or external. The most common internal cause, is the excessive distension of the coats of the vessels, produced by the humours they contain ; for it but rarely happens that the acrimony of the humours corrodes and lacerates these coats.

The

The external causes are the action of various instruments, whether balls by the force of gun-powder, contusing, cutting, or piercing, or, in any other manner acting so as to be capable of tearing the parts. It is sufficiently obvious, that all these causes act by destroying the continuity of the vessels of the part to which they are applied; so that their extremities, which when united, forming one continued canal or duct, remain open, gaping, or divided into various shreds.

Let it then be examined in what manner that pus is generated, with which a part of the human body, that has suffered such a solution of continuity, as here stated, is afterwards moistened. As soon as a rupture is made in the vessels of any part, the contained fluids at first discharge themselves sometimes copiously; then they afterwards distil drop by drop, till the evacuation is insensibly and totally stopt. But after this, the circumference of the part wounded, is generally inflated and tumified: There is also in it an intense

intense heat, and a quick sensation; a painful pulsation accompanied with a sense, very often as of burning, and these symptoms are always accompanied with more or less of a fever.

The lips of the wound are but a little moist, and sometimes entirely dry and parched. But when these symptoms are diminished the inflation of the lips subsides, and they appear moistened with a new whitish humour, moderately thick, and gently viscid, which we call PUS. When the part affected is in this last condition, we say that it has suppurated. These are the phœnomena, which generally precede, and accompany the formation of pus.

When there is a good suppuration, and a laudable discharge, it is one of the most favorable circumstances that can attend a wound; and the good or bad quality of the pus, will depend a good deal on the constitution of the patient, and the nature of the part

that has suffered from the accident. For instance in old persons, and those who have for a long time committed irregularities with regard to the non naturals, the blood is sometimes so corrupted, that if any of the parts of their bodies are but in the least wounded or compressed the suppuration is very slow, and of a bad quality.

The same happens when the mass of blood is too acrid, and divested of its serous and viscid parts, or when it is not in a condition to furnish the mucilaginious liquor so necessary to the formation of PUS. Besides, if the blood conveyed to the wounded part, is deprived of its serum, and mucilage commonly called its BALSAM, it will hardly furnish the ruptured vessels with any matter proper to be converted into PUS, or, if it does, the supply will be very slow; on account of its too thick consistence. Hence, also, too hot and aromatic substances retard the suppuration of wounds. The too frequent use of hot topics, also frequently hinders, or retards the formation

formation of PUS. Cold air is very prejudicial to suppurating parts, and all REPELLANTS, unseasonably applied, stop a suppuration. As a good suppuration is a certain sign that life subsists in the wounded parts, so when it stops, or cannot be carried on, it is a sign that the wound has a tendency to gangrene.

Gun-shot wounds made on the fleshy parts, such as the muscles, the skin and others of a similar nature, soon and easily come to a suppuration, and when the habit of body is good; the pus they furnish is in a due quantity, moderately thick, whitish, sufficiently fluid without any smell, and possessed of all the qualities of laudable PUS; and if on this occasion nothing opposes the efflorescence of flesh, laudable and well conditioned granulations begin to vegetate, as soon as the parts are well deterged, and as perfect a cicatrix as could be wished for is formed.

But this does not hold with respect to wounds received on tendinous parts, let the habit of body be ever so good, which being naturally very tense, and composed of a large quantity of nervous fibres, become very painful in the time of suppuration, which produce watchings with an acute fever, spasms of different parts, preternatural tensions of the nervous fibres, a stagnation of a hot and inflammatory blood in the extremities of the capillary vessels, and consequently violent and extensive inflammations in all the adjacent parts. Thus the wounds made in tendinous parts, are not only subject to troublesome suppurations, but also the cleansing and deterging of wounds made in them, is a long and tedious work; because having few blood vessels, and receiving only lymph, which circulates very slowly, they have not force enough to expel the PUS. Besides many of the elementary fibres of the surface of a tendon, extremely distended and lacerated with pains, becoming dry in the time of deterging, when

when all the symptoms of a suppuration are removed, will sometimes be insensibly detached from such as are sound, by the reiterated pulsations of these last, and be thrust outwards in the form of small laminæ (which is called the exfoliation of the tendon, and requires some time) that the live subjacent substance of the tendon, may produce flesh of a particular nature, proper to form a cicatrix. In all suppurations, whether laudable or the contrary, the peruvian bark should be administered liberally. In the former state its admirable qualities will favor its progress till the wound is cicatrized, and in the latter it will create a change in the fluids to generate a favorable discharge, and fortify the powers of nature to accomplish her work.

If we carefully attend to what happens, both in the vessels and humours of a part about to suppurate, it will be no hard task to discover how this purulent liquor is formed.

In order therefore to illustrate the matter more effectually, we shall examine what

passes

passes in a wound, inflicted by a bullet from the force of gunpowder.

It is to be observed then, that in the lips, and all the surface of such a wound, the vessels are in two different states; for some are cut and permit the circulating blood to flow from their orifices, whilst others which have escaped the instrument, remain intire, and maintain the life of the wounded part. It must therefore necessarily happen, that as soon as a wound is made, the liquors contained in the prodigious number of small broken vessels, which open into the cavity of the wound must be promiscuously discharged. And as among all these liquors, the largest in quantity is the blood, both on account of the larger diameters, and greater number of the blood vessels; and because the blood, as is demonstrative from physiology, circulates with greater velocity than any other humour in the human body, it follows, that such a wound must, at first, appear full of almost pure blood.

This

This hæmorrhage continues so long as the ruptured vessels are not absolutely empty, and their sides preserve a sufficient degree of tension and elasticity, to convey into the cavity of the wound, either the fluids they contain, or those propelled into them. But as these fluids are easily discharged into the wound, because at first, the opened vessels offer them no resistance; hence it follows, that in the first moments, the blood must be expressed with a velocity so great, that the motion of the subsequent fluids, cannot often equal it, on account of the resistance they meet with in the curvatures of the divided vessels. For this reason, the rapid and copious discharge of blood, will be succeeded by a depletion of the small broken vessels. On the other hand, the course of the fluids subsisting still in the sound small vessels, which enter the texture of the lips of the wound, it is evident that they must be dilated, and possess a larger space,

space, because the depletion of the ruptured vessels, totally removes the force by which they were dilated.

Hence it is obvious that the compression of the ruptured vessels will, at first, in some measure, favour the discharge of the humours bythe lips of the wound: and that the dilatation of the sound vessels, augmenting gradually, will so compress and brace up the ruptured vessels,that the hæmorrhage will at last cease intirely. The extremities of the ruptured vessels are principally compressed, as being weaker in that part, in consequence of the dilaceration, than in any other.

Besides what contributes still farther to stop the hæmorrhage is, that the ruptured vessels, by the contraction of their longitudinal fibres, retire into the substance of the part, as usually happens in all cut vessels; so that the orifices of the vessels, which have been lacerated, are concealed by the interstices between the sound vessels. Another reason

reason why hæmorrhages stop in wounds is, because, as soon as the velocity with which the blood was discharged is diminished the circulatory fibres, which remained sound, and which are nearest to the lacerated part, being no longer dilated by the afflux of the blood, naturally contract themselves, and begin to constrict the extremities of the divided vessels.

To all these considerations we must add, that the fluids which fall drop by drop, being no longer agitated by the progressive motion on which life depends, will, when they arrive at the shreds of the ruptured vessels lose their natural fluidity, and be coagulated; which effect is, in a great measure, also produced by the action of the air.

When therefore the discharge of the fluids into the cavity of the wound is diminished, we may easily conceive, that the extremities of the ruptured vessels are stopt, constricted, and compressed.

But since the infliction of the wound, the small trunks of the arterial and lymphatic vessels, which are not empty, and which are distributed to the lips of the wound, are still the same, and equally numerous, the blood and lymph will continue to arrive in the same quantity, and with equal velocity in the lips of the wound ; but as they cannot be received into the ruptured vessels, whose extremities are contracted, with the same ease they were before, it necessarily follows, that the ordinary circulation being by this means destroyed and interrupted, not only the ruptured vessels must be considerably dilated at their origins, but also, that the fluids must be determined in greater quantities, than usual into the sound vessels; and even that this redundant quantity must be proportioned to that, which cannot in a determined space of time, pass through the ruptured vessels, on account of the resistance it meets with in their extremities. Besides, when the

the entire vessels thus suddenly receive this load of humours, they are distended, and almost overpowered by it, and the recurrent vessels not allowing the humours to return with the same velocity with which they arrived at the wound, it happens that both the ruptured and entire vessels are greatly inflated and infarcted with blood, the fluid which most abounds in the part. Hence arise the tumour, the redness, the heat, and the uneasiness in the lips of the wound. Hence also arises the painful pulsation, accompanied with a sense of heat, perceived in the wounded part; for at every contraction of the heart, the small arteries before afflicted with violent pain, by the great distension of their coats by the blood, receive a new quantity of that fluid, which by dilating them still more, renders the pain intolerable, by the irritation it occasions. When all these symptoms are present, the vessels in the lips of the wound are extremely distended, the

fibres are strongly and quickly agitated, and all the humours, especially the blood, being embarrassed in their course, form congestions, accompanied with heat and inflammation, which greatly affect the wounded part.

The symptoms of a gun-shot wound are not confined to the wound alone, since the whole body is also often affected; for the patient is sometimes seized with shiverings and tremblings, which agitate all his limbs; and generally more or less of an acute fever burns him internally. Indeed, it can hardly happen that ligaments, and membranous parts can be torn and distended, by an extraneous body with the force of gun-powder, without producing a violent agitation of the nervous system; in consequence of which, the whole body will, by means of SYMPATHY, be agitated and tremble, the patient in the mean time perceiving an universal disorder in the animal economy.

The

The more exquisite the sensation of the wounded part is, that is the more numerous and tense the nervous fibres are which enter its texture, the more violent will the shocks of the nervous system be; and all other circumstances being equal, they will also be the more considerable, in proportion to the extent of the wound.

These violent agitations of the nerves of a wounded part, in consequence of the continuity of the whole nervous system, are communicated to the nerves dispersed through the whole body, which are irregularly agitated by them: that they produce here and there, in the fleshy and membranous fibres, crispations, and contractions equally irregular. Hence it is that in large wounds inflicted on parts of exquisite sensation, the suppuration is sometimes preceded by shiverings all over the body. At this time the patient feels a kind of cold, which is not very violent; but only an apparent cold, since the body is not really

really so, It has however, sometimes happened, that when in a suppuration the patient shivers, the body has felt actually cold to the touch, but this only happens when the pus is completely formed, and ready to be discharged by the lips of the wound.

We shall in the subsequent observations endeavour to explain how this happens.

As shiverings are the forerunners of a suppuration, in large and painful wounds, so a fever generally precedes, and accompanies the formation of pus in wounds of this kind; for when the pain and heat of the wounded part, denotes that it is ready to enter into a suppuration, the patient begins to feel shiverings sometimes all over his body, as has been already observed.

Then he becomes gradually hotter and hotter till an acute fever is excited. The true cause of this fever, is nothing else but the painful vibration of the nervous fibres of the suppurating part, which communicating with all the other filaments of the nerves, on account

account of their continuity, at least, with those of the brain, determine the nervous fluid to flow copiously into their cavities, and produce a greater tension and rigidity in the nervous system. By this means there is produced an augmentation of force in the heart, arteries and texture of all the viscera. Hence the solids act more forcibly on the blood, by which means it circulates with greater velocity, and the humours are more rarified. This accounts for the frequent and full pulse, the burning heat of the whole body, and the acute fever. But what still augments the fever, is, that the over heated blood in the lips of the wound, whatever difficulty it finds to return by the veins, yet does so, and mixing with the whole mass of blood, augments the motion of its molecules, and consequently disposes it to acquire a greater rarification. While the solids and fluids, act thus reciprocally on each other, in the suppurating part, the ruptured vessels hardly

make

make the least oscillation; for, as on one hand, they want a fixed stay, or support, in consequence of the laceration of their extremities, and, as on the other hand, they have in consequence of the retraction of their longitudinal fibres, lost that strong tension, and elasticity which enabled them to re-act on the fluids they receive, we may therefore look upon them as useless and almost mortified vessels in the lips of a wound.

However as they are greatly inflated in their origins, by the fluids which their excretory vessels force into their cavities; as they hardly act upon these fluids, and as the sound blood vessels, in the adjacent parts, beat violently on the contiguous parts, it must necessarily follow, that those brisk pulsations, and dilatations, carried to excess, must compress the ruptured vessels, and so constrict them, that they make an effort to expel the fluid which they contain. But this fluid is become thick by its continuance, and is consequently

sequently in an improper state for being discharged. Besides, the lacerated extremities of the vessels are so constricted, that they make a great resistance to it, and the vessels which continually force fluids into those which are ruptured, still more powerfully oppose its reflux.

It is, therefore, only by a number of reiterated actions of the sound upon the ruptured vessels, that the wounded part can be freed from this liquor, absolutely incapable of returning into the course of the circulation, Though this liquor is thus agitated by these compressions, and repeated pulsations, yet it remains without any change of place; in which respect it is quite different from what it was in its natural state, when the immediate actions of the vessels which contained it, made it flow freely through their cavities; which shews us the great difference between the fluids of the ruptured vessels of a suppurating part, and those circulating in sound and entire vessels.

It is not therefore surprizing that the suppurative motion should produce a new and particular liquor which is not to be found in the body, when in a natural state; for in this last case, the blood being propelled gently and equably, by the elasticity of the blood vessels, whose coats immediately touch it, its red globules being separated from each other, swim freely with the fibrous parts, in a mucilaginious and aqueous fluid, so that it easily passes through the most minute blood vessels. But in the work of suppuration, the blood stagnates at the part from whence the ruptured vessels are conveyed, for which reason the red globules and fibrous part are coagulated, and having expressed the most fluid serum from their interstices, this serum transpires through the extremities of the ruptured vessels, or is dissipated by the heat of the part, so that the red globules uniting into one mass with the fibrous parts, which are mixed with them, remain

remain embarrassed among the mucilaginious parts of the blood. It is, on this occasion, that the sound vessels acting on this mass of coagulated globules which have entirely lost their fluidity, compress, attenuate, and break its molecules, so that they convert into a homogenious, liquor, which being afterwards intimately mixed, by means of these pulsations, with the fibrous, lymphatick, and mucilaginous parts, which are naturally white, it entirely loses its red colour, and becomes a fluid considerably thick, and of a sordid white colour, called PUS, and which gradually acquiring more fluidity, in proportion as the action of the sound vessels continues to divide it, is at last expressed into the wound through the extremities of the ruptured vessels. This expression of the PUS into the wound is easily made, because the lacerated extremities of the vessels being, soon after the reception of the wound, entirely deprived of life, easily yield to the efforts of the sound vessels to dilate them.

Besides, the extremities of the vessels softened by the mortifications, are separated, and confound themselves, in the lips of a wound with the PUS, and contribute to give it a white colour, which as being solid parts, they have themselves.

What happens in the amputation of limbs, convinces us that the extremities of ruptured vessels are thus separated.

There is no manner of doubt but these extremities are really lacerated in gun-shot wounds and contusions, and likewise in wounds made by swords and other cutting instruments; for however good and sharp the edge of these instruments may be, yet when we examine them with a microscope, it appears rough and uneven, and consequently cannot cut the parts without tearing them.

The lymph a whitish and moderately thick liquor, which ouzes from the orifices of the ruptured lymphatick or neurolymphatick vessels, and which is expressed by the pulsation

sation of the sound vessels, is also mixed with the PUS in the lips of a wound; for every thing that happens to the blood vessels, also happens to those of the lymphatick kind, when torn: That is, after the reception of the wound, the lymph stagnates in the ruptured lymphaticks, by the same mechanism that the blood does in the blood vessels.

It is also inspisated, and coagulated, afterwards violently agitated, and lastly determined to flow through the orifices of the lacerated vessels. As for the liquor discharged from the nervous filaments, it is so small in quantity, that it can hardly be said to enter the composition of the PUS.

We have therefore endeavoured to demonstrate, that the PUS is a mixture of various ingredients in the inequalities of the surface of a wound, namely, blood, which has lost all its redness, and is the largest ingredient in the mixture; a little vicid lymphatick juice, and the extremities of the lacerated

rated vessels which fall off in small portions, and are converted into a soft and whitish kind of glue.

The efficient cause, therefore, of a suppuration, is the oscillatory motion of the sound vessels, especially of the sanguiferous kind, which being more distended, and beating more frequently than usual, when they dilate themselves, strongly compress and agitate the ruptured vessels, which are full of stagnant fluid; so that it is easy to conceive, that in a suppurating part there must be an inflammation, or, at least an intense heat.

The blood and lymph becoming stagnant in the ruptured vessels, and even the extremities of these vessels constitute the PUS. These three substances, in consequence of their being contused and lacerated from a wound, are really destined for MORTIFICATION; for the blood and lymph, by this accident being placed without the bounds of the circulation, are no longer subject to the same laws; and the lacerated extremities of the

the vessels having lost their pulsatory motion, are no longer proper to transmit the fluids.

All the efforts of nature, therefore, in a suppuration, only tend to relieve herself, and separate from the living parts, this noxious mixture.

By nature, on such occasions, we mean no more than an increase, and greater activity of the vital motion of the vessels of a live and suppurating part

Such, in my opinion, is the efficient cause of a suppuration, such its matter, and such the end and design of nature in performing this work.

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